Underground Storage Tank Program
Iowa Department of Natural Resources

COMPLIANCE INSPECTION GUIDE

Underground Storage Tank Section
Geological Survey & Land Quality Bureau
Environmental Services Division

JULY, 2007

To Report A Release To The Environment

Call the Department's

24 Hour Emergency Response Phone Number:

515/281-8694

TABLE OF CONTENTS

INTRODUCTION

The purpose of this Guide is to assist Iowa certified compliance Inspectors in completing a successful compliance inspection of a regulated underground storage tank (UST) facility. Given the DNR regulations and requirements for installing, operating and maintaining UST systems, and all the technological complexity of a compliance inspection, it is necessary to have a training resource the inspector can take into the field. This inspection manual should complement the rules and regulations with a practical hands-on resource and make the inspector feel more comfortable and confident in performing an UST compliance inspection.

In the spring of 2006, DNR adopted regulations that require the inspection of regulated UST systems every two years by an Iowa certified inspector. The change should benefit both owners/operators and the DNR. The DNR believes biennial inspections will increase compliance and better protect groundwater. By using private, certified inspectors, field office personnel will be able to concentrate on enforcement and other program areas of the DNR. Owners and operators should be able to improve compliance with a shorter compliance inspection schedule.

There are some items that don't change, namely our mission:

1. **Preventing spills, leaks and releases through greater inspection frequency**
2. **Discovering little problems before they become larger and more serious**
3. **Promoting operation and maintenance practices that help extend the life of the UST system and keep owners and operators in compliance**

Greater inspection frequency improves UST compliance and results in fewer problems. We've had a lot of leaking sites in Iowa that we are still dealing with in terms of cost and cleanup. This is not a legacy we want to maintain. We must maintain UST facilities and still protect groundwater and public health. The best way to do that is through the three items listed above.

Equipment will be encountered that is not found in this guide. Situations will arise which are not addressed in this manual. We encourage your input through comments, photographs, text additions and feedback. The DNR expects to provide future updates. We are grateful to the states of New Jersey and Alaska for their assistance with this project.

We welcome your assistance as a compliance inspector to ensure UST systems are operated and maintained to prevent future costly leaks, to help ensure that UST owners and operators identify problems early-on if they occur and, ultimately, to protect public health and the environment.

Elaine R. Douskey, Supervisor
Underground Storage Tank Section

Definitions/Glossary

Accumulator: a device that stores product, which can be used to prevent false line pressure alarms in pressurized systems. Pressure losses are a result of the contraction of product as it cools, especially in colder weather. The accumulator slowly releases product to the line to maintain a constant minimum pressure and is commonly used with Veeder-Root Constant Pressure Turbines® (CPT), and Simplicity® and Red Jacket 4000 PPM monitoring systems.

Annular Space: the space created between the primary and secondary container of a double-walled underground storage tank system.

American Petroleum Institute (API): an organization of business and industry representatives responsible for developing procedures for the installation, operation and testing of UST systems.

Automatic Tank Gauging (ATG): a system of sensors, probes and pressure transducers wired to a control panel. The system can monitor lines, tanks, submersible turbine pump (STP) sumps, dispenser pans, and tank and interstitial areas for leaks at a rate of 0.1, 0.2 and 3 gph depending on the equipment present. In the most basic form, the ATG only monitors the product level and can be used for overfill protection when connected to an alarm (horn/light). The panel can be programmed to run tests of the system daily, weekly or monthly. Veeder-Root, Red Jacket, EBW, Simmons Wilco, Emco Wheaton and Incon make some of the more common units. The features and functions vary greatly. Contact the department for specific information, maintenance requirements and third party certification.

Automatic Tank Gauge Probe (ATG Probe): used to monitor product level in an underground storage tank (UST) for inventory records and/or for monthly leak detection monitoring.

Boots: (also known as reducer boots or test boots) are made of nitrile or similar materials and are fitted to the end of double-wall piping, especially in product tight sumps. The boots are tightened to isolate the interstitial portion of double-wall lines for pressure testing to verify integrity. During normal operation the boots must be loose or have an open nipple to allow any fluid that leaks into the interstitial space to be detected by liquid sump sensors or other means of monitoring.

Bravo Box (B-2000): a product-tight dispenser pan installed inside and under a dispenser, that prevents leaking product from the internal dispenser components from entering the environment. The Bravo Box (made by Sergio Bravo) has a float for each shear valve (only on pressurized systems); and if more than 5 fluid ounces of product is spilled, the float will shut off the shear valve (also known as impact valve) which stops the flow of product. The floats are black and have chains attached to each shear valve. There are other types of dispenser pans (e.g., Environ & Total Containment), but the B-2000 can actively stop a leak from continuing.

Capacitor: an electrical storage device located on the top of the Submersible Turbine Pump (STP) that helps start the turbine motor. Some types of Wireless Line Leak Detectors (WLLD) prevent the capacitor from charging when a loss of line pressure is detected. This prevents the STP from starting.

Cathodic Protection: a technique to prevent corrosion of a metal surface by making that surface the cathode of an electrochemical cell.

Cathodic Protection Test Port: typically a 3-inch diameter metal or plastic cover mounted flush with the tank field paving. Upon removal of the cover, you will find wires directly connected to tanks and/or lines. These wires allow direct electrical connection to the tanks and or lines to permit a cathodic test to be performed. They are most commonly associated with the installation of Sti-P3 tanks because all tank risers (including the STP where fitted) are insulated with dialectric bushings which prevent electrical connections with the tanks proper. A PP4 test port is similar, but has a flying "built in" reference cell; therefore, do not use your reference cell to perform a cathodic protection test. The center terminal is connected to the reference cell.

Close or Closure: the permanent elimination from service of any underground storage tank system by removal or abandonment in place.

Coating: this can be asphalt, paint, fiberglass reinforced plastic (FRP) or epoxy applied as a coating to the outside surface of a tank during manufacture. It cannot be added later. In some cases, this coating (FRP or epoxy) can serve as a method of corrosion protection for tanks constructed of steel.

Coaxial: commonly used to describe a double-wall drop tube used for the dual purpose of filling the tank with product and of recovering vapors (Stage I). In non-attainment areas, the inner pipe is used to fill the tank, while the larger outer pipe returns the fuel vapors to the tanker. Check the coaxials carefully; they may contain overfill valves (commonly manufactured by OPW/EBW). Coaxial also refers to a double-wall fiberglass product line in which the interstitial area is filled with fine-grained sand.

Composite Tank: steel tank with a fiberglass reinforced plastic (FRP) coating or laminate bonded to its exterior. Composite tanks were introduced in the 1980s. The thick FRP coating removes one of the elements needed for corrosion to occur--the electrolyte or backfill. The steel is isolated from the backfill by the FRP coating. An ACT-100® is a composite tank with a 100 mil-thick (0.1") coating.

Contaminant: any discharged regulated substance.

Continuous Monitoring: a monitoring system that incorporates automatic equipment that can detect leaks and/or discharges without interruption.

Corrosion: the deterioration of a metal (typically ferrous) by direct or electrochemical reaction with its environment.

Corrosion Protection (for steel tanks and lines): There are two types of corrosion systems for steel lines and tanks. The passive or sacrificial anode system relies on anodes attached to the tank ends or spike anodes attached to the lines. These anodes (commonly zinc, magnesium, or aluminum) are more electro-chemically active than steel. By corroding preferentially over bare steel, anodes protect the tanks/lines from corrosion. The impressed current system uses a rectifier to convert 120 volts AC (VAC) into direct current (DC) which enters the ground through wires attached to anodes.

Constant Pressure Turbine (CPT): A submersible turbine pump (STP) made by Marley (Red Jacket). This pump uses a product line pressure transducer to monitor line pressure and a frequency control box that can control the speed of the pump. If several cars are being fueled at one time, a drop in line pressure tells the turbine to speed up, thereby maintaining the filling rate. When the pump is off, the pressure transducer can perform line leak detection by sensing line pressure decay. The monitoring system is typically a Prolink/PPM unit (although many PPM units are still in

service, Marley has discontinued their manufacture). See the photo in the manual of a CPT or visit http://www.redjacket.com/default.htm.

Department: the Iowa Department of Natural Resources.

Dielectric: a material that does not readily conduct electricity such as PVC, fiberglass, neoprene or rubber. Dielectric bushings are used on steel tanks to prevent current from the turbine or lines from reaching the UST.

Discharge: an intentional or unintentional action or omission resulting in the releasing, spilling, leaking, pumping, pouring, emitting, emptying or dumping of a regulated substance into the waters or onto the lands of the state or into the waters outside the jurisdiction of the state, when damage may result to the lands, waters, or natural resources within the jurisdiction of the state.

Discharge Detection System: means a method of detecting a discharge of regulated substances from an underground storage tank system.

Dispenser pan: a product-tight chamber beneath the fuel dispenser designed to contain any product that may leak from any dispenser valves or during a dispenser filter change. These devices are not required, but certainly are a good management practice.

Double-Walled Tank: an underground storage tank in which a rigid secondary container is attached to the primary container. The two containers create an annular space which is commonly monitored for leak detection (tanks).

Drop Tube: pipe directly over the UST extending to grade which is used to fill the UST with product. It may be a single-wall or coaxial tube. The drop tube must extend to within one foot of the bottom of the UST to help stabilize fuel during delivery for accurate product level measurements as part of certain types of leak detection monitoring. The use of drop tubes also minimizes the generation of static electricity resulting from fuel turbulence caused when filling a tank.

Dry Break: a spring-loaded check valve used for Stage I vapor recovery (NA in Iowa). This vapor check valve is connected to the tanker during product delivery and the displaced vapors from the tank are routed back to the tanker. In many cases, the 90% flow restrictor (ball float) for overfill protection is located under the dry break; however, in this application, the dry break MUST be located directly above the centerline of the tank.

Empty: all regulated substances have been removed from an UST that can be removed by direct pumping or drainage, and no more than 2.5 centimeters (one inch) of residue, or 0.3 percent by weight of the total capacity of the system remains, whichever is the smaller amount.

Estabrook: a device used to simulate a 3-gallon per hour line leak rate. This piece of equipment is used in the annual test of line leak detectors (LLD).

Facility: one or more underground storage tank systems owned by one person on a contiguous piece of property.

Fiberglass Reducer: serves the same function as a rubber test boot (see boot definition) to allow for the tightness testing of double-walled lines.

Fill Port: the end of the drop tube at ground surface where product is introduced into an UST. It will be covered with a color-coded outer steel plate (proposed rule) and an inner cap. Annual (colored) or permanent (silver) tags must be attached and readily visible.

Financial Responsibility for Underground Storage Tanks: the assurance, through one or more allowable mechanisms, pursuant to 567—136 IAC, of the availability of funds necessary for the cleanup or mitigation of a discharge of a petroleum substance and for third party liability.

Flex Line: a product line made of a continuous flexible material. Fittings such as elbows and tees are not required on Flex lines. These lines can be single and double-wall. They do not require corrosion protection. These lines are known as Environ's Geolflex®, Total Containment® and Poly Tech®, among others.

Free Product: a non-aqueous-phase liquid, present in concentrations greater than a contaminant's residual saturation point, with a positive pressure so the material can flow.

FRP (Fiberglass Reinforced Plastic): A non-corroding material used in the construction of tanks, lines and sumps.

Functional Element: a check valve device found on submersible turbine pumps (STPs) used in pressurized systems. The functional element maintains line pressure when the turbine motor is shut off. The functional element can also be used to establish a siphon break for manifolded tanks or a siphon line for Stage II drop tanks.

Geoflex: a double-wall plastic product line (manufactured by Environ) that is installed as one piece. Because it is flexible, connections and fittings are not required. Typically, Geoflex. lines are bright green in color.

Hazardous Substance UST System: an underground storage tank system that contains a hazardous substance defined in Section 101(14) of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) of 1980 (but not including any substance regulated as a hazardous waste under subtitle C), or any mixture of such substances and petroleum, and which is not a petroleum UST system. See definitions 567-135.2 IAC.

Healy: one manufacturer of Stage II vapor recovery pumps (NA in Iowa). These units can be powered by pressurized gasoline or electricity. They generate a vacuum which in turn draws the vapors to the regular grade tank. The Mini-Jet, Vacu-Jet and Multi-Jet pumps operate on pressurized gasoline from an STP and are located at the tank field. The electric units, also known as vac-motors, are typically located in the dispensers.

Healy Mini-Jet (9000)® and Vacu-Jet (200 & 400)® (NA in Iowa): product-driven units that produce up to 80 inches (water) of vacuum. They are usually found at the tanks (tank field area), and the vacuum pulls the Stage II vapors back to the lowest grade tank present (usually Regular grade). Most commonly found at Sunoco and Hess/Merit sites. These items are used in the Healy type of Stage II systems and are components used for Stage II vapor recovery compliance.

Heating Oil: any grade of petroleum product including, but not limited to: No. 1, 2, 4 (light and heavy), 5 (light and heavy) and 6 fuel oils, and other fuels when used to substitute for one of these fuel oils and used to heat residential, industrial or commercial premises.

Hydrostatic Test: an integrity test of the spill buckets and/or the submersible turbine pump (STP) sumps using water. The containment vessels are filled above their highest wall penetration with water, the level is recorded over time, and a drop in water level indicates a leak. Water used for this test must be managed properly as it may become contaminated with product.

Impressed current system: a method of external cathodic protection for tanks and/or product lines. The system uses a rectifier which converts alternating current (AC) to direct current (DC) which is then introduced into the ground around the tanks and lines by a series of wires and anodes. The current prevents the steel tanks and lines from corroding. The panel (rectifier) must be checked for operation every 60 days and the tanks and lines must be tested a minimum of every three years.

Interstitial: the space between two walls of a double walled UST or piping system.

Inventory Control: technique used to identify a loss of product based on volumetric measurements in the underground storage tank and reconciliation of these measurements with regulated substance delivery and withdrawal records.

Jacketed Tank: combines a primary steel tank and a non-corrodible (either FRP or HDPE) outer tank. Jacketed tanks have all the characteristics of double-walled tank construction, (i.e., interstitial monitoring and secondary containment, but use a type of plastic to surround the steel tank instead of steel laid over steel or fiberglass laid over fiberglass). Again, the steel primary tank is isolated from the electrolyte or backfill; therefore, external corrosion is prevented. One such design of a jacketed tank is STI Permatank®, which uses FRP for its outer wall.

Leak: In general, leak means the same thing as release (spill, discharge, etc.), but technically refers to a release that is contained (i.e., doesn't reach the environment). For example, leak could mean the release of a regulated substance from an underground storage tank system into the interstitial or annular space of a UST system. A leak can usually be detected in the interstice or annular space before it becomes a release to the soil or groundwater. A leak may also be observed in dispensers perhaps from the piping and contained by the sump. A leak is usually detected by either visual inspection or an approved release detection method before it enters the environment.

Lining: a non-corrodible material such as fiberglass reinforced plastic or an epoxy that is applied to the inside of a tank during manufacture or added at a later date as a corrosion upgrade. This corrosion protection material must be chemically resistant to the regulated substance stored, and bonded firmly to the interior surface of the tank, pipe, line, fixture or other equipment.

Liquid: any material which has a fluidity greater than that of 300-penetration asphalt when tested in accordance with the ASTM D-5-78 Test for Penetration for Bituminous Materials. If not specified, liquid shall mean both combustible and noncombustible liquids.

Liquid Sensor: a monitoring system that detects the liquid phase of a regulated substance.

Liquid Sensors: electro-mechanical devices primarily used to detect liquids present in sumps or tank/line interstitial areas. The sensors fall into two general categories: discriminating, which only detect product, and non-discriminating, which can only detect a liquid. They can use floats with reed switches or electronic probes to detect liquids.

Line Leak Detector, or LLD: is a mechanical device that is fitted to the submersible turbine pump (STP) which either stops or restricts product flow when a leak rate of 3 gph or greater is detected.

There are several common models made by F.E. Petro®, Marley Pump® and Vaporless® Manufacturing. These units require annual testing (manufacturer's requirement).

Manifolded: the use of a physical connection (siphon bar) between two or more tanks of the same contents--typically regular grade gasoline or diesel fuel.

Manway: a large opening in an UST used to access the UST for internal inspections. Can be factory or field installed after an UST is lined.

Marley: the Marley Pump Company which manufactures petroleum and water pumps, dispensing and monitoring equipment. The brand name is Red Jacket®
http://www.redjacket.com.

Monitor Well: a well used to observe the elevation of the water table or potentiometric surface, or to determine water quality in an aquifer.

Monitoring System: either a discharge detection system or leak detection system capable of detecting leaks or discharges, or both (other than an inventory control system) used in conjunction with an underground storage tank, or a facility conforming to criteria established in 567--135.5 IAC.

MPD: acronym commonly used by tank contractors, owners and operators when referring to Multi-Product Dispensers which are typically found at stations that have been upgraded.

National Fire Protection Association (NFPA): brings together fire and safety professionals (among other volunteers representing varied points of view) to develop guides, NFPA codes, standards and recommended practices. The NFPA publishes standards, codes and recommended practices related to underground storage tanks, such as *Handling Releases of Flammable and Combustible Liquids and Gases* (NFPA 329*), Standard for Tank Vehicles for Flammable and Combustible Liquids* (NFPA 385), *Standard for the Safeguarding of Tanks and Containers for Entry, Cleaning or Repair* (NFPA 326), *Code for Motor Fuel Dispensing Facilities and Repair Garages* (NFPA 30A), and *Flammable and Combustible Liquids Code* (NFPA 30).

National Association of Corrosion Engineers (NACE): establishes standards and recommended practices for corrosion protection of buried metal structures such as underground storage tank systems and pipelines.

National Work Group on Leak Detection Evaluation's (NWGLDE): reviews third party leak detection equipment evaluations conducted by third party evaluators with approved protocol and leak rates blind to the evaluator. All leak detection equipment/methods must undergo third party evaluation and approval before use in regulated USTs in Iowa. The work group is made up of state and EPA UST program staff. This is an important reference for the inspector. At some point, you will have to look up an evaluation for leak detection equipment to see if it's operating/testing according to the evaluation criteria. The website is http://nwglde.org

Non-operational Storage Tank: any underground storage tank in which regulated substances are not contained or from which regulated substances are not dispensed.

Operational Storage Tank: any underground storage tank in which regulated substances are contained or from which regulated substances are dispensed.

Operator: any person who leases, operates, controls, supervises or has responsibility for the daily operation of a facility, or any person who has the authority to operate, control or supervise the daily operation of a facility.

Out-of-Service Storage Tank: any underground storage tank system in which regulated substances are contained or have been contained, but from which regulated substances are not or have not been introduced or dispensed pending a decision to close the system or to begin reuse of the system.

Overfill Prevention: means the use of a mechanical or electrical device designed to restrict or stop the transfer of regulated substances from a delivery vehicle to a tank or to alert the operator that the tank is nearly full.

Owner: For purposes of active underground storage tanks, owner refers to the person or corporate entity that owns the USTS used for storage or dispensing of petroleum. The owner is usually the person who acknowledges ownership on the DNR's tank registration form. In cases where there is no written evidence to show who owns the tank, the owner of the property may be deemed to be the tank owner.

Petroleum Equipment Institute (PEI): petroleum equipment service organization based in Tulsa, OK, comprised of business and industry representatives responsible for developing recommended practices, operation and testing of UST systems.

Piping or Pipe: any hollow cylinder or tubular conveyance which contains a regulated substance or routinely contains a regulated substance, is in contact with the ground and is constructed of non-earthen materials, including any fill pipe, valves, elbows, joints, flanges and flexible connections. Piping does not include vent lines, vapor recovery lines or fittings located on top of the tank.

Pressure Degradation Test: an integrity test of tanks, lines, interstitial areas and Stage II lines using pressurized helium, nitrogen or product. A drop in the pressure indicates a leak.

Pressure Transducer: an electrical device that, when used in conjunction with an automatic tank gauge (ATG) system or as part of a wireless line leak detector (WLLD), can detect a decrease in product line pressure. This decrease in pressure can result in an alarm being triggered or the product pump being turned off. Most of these units are capable of detecting leaks of 0.1, 0.2 and 3 gph. See also SwiftCheck.

Primary Container: the first level of containment which comes into immediate contact on its inner surface with the regulated substance being contained (for example, a single-walled tank or the inner wall of a double-walled UST).

Probes: electromechanical devices used in conjunction with monitoring systems (ATGs) to measure product levels in tanks. The common use is the reference to in-tank probes which typically measure the amount of product, ullage (empty portion of UST), water and temperature present in the tank.

Product Tight: impervious to the regulated substance contained or to be contained so as to prevent a release.

Quantum®: a specific model name of submersible turbine pump (STP) manufactured by Marley Pump. See also "Red Jacket®/Veeder Root."

Rectifier: see "Impressed Current system."

Red Jacket®: registered trade name for a line of petroleum dispensing, pumping and monitoring equipment manufactured by the Marley Pump Company and bought by Veeder Root. Red Jacket® has become synonymous with all mechanical line leak detectors (LLDs). The LLD is designed to monitor line pressure (pressurized systems only). If a leak exceeds 3 gph, the Red Jacket® slows the flow rate, thereby signaling a line pressure loss.

Reference Cell: also known as a ½ cell or a copper/copper sulfate cell. This item is used with a multimeter to perform a cathodic test of passive and impressed systems. See both sections of Corrosion Protection in the Compliance and in the Photos/Equipment Sections.

Registration Form (148): a control document issued by the department to implement the registration requirements of 567--135.3(3) IAC.

Release: a leak or discharge of a regulated substance from an underground storage tank system.

Release detection monitoring (RDM): all product-bearing lines and tanks must be tested monthly at a leak rate of .2 gph. Owners/operators must be able to document compliance with this requirement. RDM has been a requirement since 12/22/1993. Product lines for a European suction system do not require testing. See Safer suction system in this section.

Release detection observation well: an access point constructed of screen and casing, which may be used in conjunction with a monitoring system to detect a release of regulated substance stored in the underground storage tank system either in the vapor or liquid phase.

Release Investigation: a release investigation as defined in 567--135.6(3) IAC.

Remedial or Corrective Action: remedial action as defined in the Corrective Action Requirements, 567--135.6 IAC.

Riser: any vertical pipe connected to a tank: drop tubes and 90% flow restrictors are found in risers. Small diameter risers (2-inch) are commonly used to gain access to the interstitial area of double-wall tanks.

Safer Suction System: refers to non-pressurized product delivery, also called *European* (where it is common). In a safer suction system, the pump is located at the dispenser instead of in the tank and pulls the product from the tank instead of pushing it. Piping is sloped back to the tank and one check valve (union check valve) is located beneath the pump in the dispenser to hold product in the piping. If a release occurs in the pipe, the prime would be broken and the product would drain.

Secondary Containment: an additional layer of impervious material creating a space wherein a leak of regulated substances from an underground storage tank system may be detected before it enters the environment.

Shear Valve: also known as an impact valve. This is a valve unit located in the base of all pressurized dispensers. If the dispenser is knocked over, the valve shuts off fuel flow from the submersible turbine pump (STP). The shear valve also has a fusible link attached to the side of the valve body. If a fire occurs, this link melts and the spring-loaded valve shuts, thus stopping the fuel flow.

Sherlock.: a vacuum test developed by Crompco for testing the integrity of spill buckets.

Simplicity®: this system has been changed to FMS or Fuel Management Services. FMS is a wholesale replacement of Simplicity. It is functionally identical except the user can now select from broader service options. FMS is a type of automatic tank gauging monitoring system where data, alarms, etc., are relayed to Veeder Root FMS operations center in Greensborough, NC. Exxon commonly uses FMS for tank RDM and uses a pressure transducer wired to the panel for line leak detection.

Siphon Break: a mechanical or electrical (solenoid valve) device that prevents manifolded tanks from siphoning into each other which can be a problem when using in-tank probes for leak detection. The most common mechanical siphon break can be recognized by a 3/8-inch copper pipe connecting the tanks and vented at the functional element on the submersible turbine pump (STP). Look for the pipe in the STP sumps.

Site: the contiguous piece of property at which a facility is located.

Site Investigation or Site Check: site investigation or site check as defined in 567--135.6(3) “b”.

Slave Tank: a tank that is manifolded to another tank of the same product by means of a siphon bar. The slave tank does not have a dedicated STP nor is it connected directly to a dispenser.

Spill Bucket: a product-tight chamber that surrounds the fill port riser. It is designed to capture any product that may spill when disconnecting the delivery truck hose from the UST fill port riser.

Spill Prevention: the use of a spill bucket on the fill pipe riser to prevent a discharge during the transfer of regulated substances from a delivery vehicle to a tank.

Stage I Vapor Recovery (NA for Iowa at this time): the vapor recovery system that is used to recover vapors generated during a delivery to an UST. They can consist of a coaxial drop tube, which consists of an inner (product delivery) and an outer (vapor return) pipe, or the second type which uses a vapor check valve (dry break) and associated piping to return tank vapors to the delivery truck. The vapor check valve, which is found under an orange cover at the tank field, is more common and can be manifolded so one valve handles all the tanks. Vapor recovery systems are required for the purpose of air pollution control in designated non-attainment areas.

Stage II Vapor Recovery (NA in Iowa): a means of recovering gasoline vapors generated when filling a vehicle’s fuel tank. The Balance system, which is the most common, relies on the bellows and coaxial hoses of the dispenser to route the vapors to a buried system of piping that is pitched towards the lowest grade fuel tank at the site. If the 1/8-inch-per-foot pitch cannot be maintained, a drop tank has to be installed. The Healy system relies on a Mini-Jet or a Vacu-Jet to draw the vapors to the lowest grade fuel tank. A vac motor (such as a VP-1000) or assisted system uses an electric blower at the dispenser to pull the vapors to the recovery lines at the dispenser base. The Stage II system is outside the realm of leak detection, but can be a source of leaks and contamination. You can request a pressure degradation test and a block test (wet & dry) to be performed per the California Air Resources Board (CARB) method.

sti-P3®: The Steel Tank Institute (STI) introduced this tank in 1969 as the first corrosion-resistant steel tank. Many improvements had been made with the tank since then. These were popular tanks until composites started taking over in the 1990s. The sti-P3® is a steel tank with a durable, dialectric coating, zinc or magnesium anodes attached to the ends of the tank and dielectric bushings to isolate

the tank from other fittings (risers, STPs). Hence, the tank's name which indicates the three levels of corrosion protection. These tanks can be either single or double-wall.

Statistical Inventory Reconciliation (SIR): a third-party certified method of monthly line and tank release detection. Stick readings, delivery and sales totals are processed using a computer program which shows PASS, FAIL, or INCONCLUSIVE results for each tank and its product piping. This type of monitoring is common because at minimum a gauge stick is required. Some owners/operators collect the tank readings with an ATG.

Submersible Turbine Pump (STP): these pumps, which are located in the tank, deliver product by pressurizing the product lines which run from the tank to the dispenser. Common units are made by Marley (painted red) and F.E. Petro (painted blue).

Submersible Turbine Pump (STP) Sump: the below grade housing for a submersible turbine pump (STP). Some of these sumps are product tight, but many sumps are made of concrete blocks with soil at the bottom.

Substantial Modification: any construction at, or restoration, refurbishment or renovation of, an existing facility which increases or decreases the in-place storage capacity of the facility or alters the physical configuration, or impairs or affects the physical integrity of the facility or its monitoring systems.

Suction Piping: this is the product delivery method that uses a suction pump located in the dispenser. There are two types: 1) The American (angle check) has a check valve at the tank. This check valve usually is paved over and cannot be seen. The American system requires line testing every three years. 2) The European (safe suction or union check) has a check valve in the union immediately below the suction pump located in the dispenser. This type of system does not require line testing. The owner/operator must document which system is present.

SwiftCheck: a 4-inch black steel check valve (riser), manufactured by Veeder-Root, attached to a pressure transducer, the combination of which tests the product lines to 0.1, 0.2 and 3 gallons per hour (gph). Located on submersible turbine pumps (STPs) where the LLD is normally fitted, the SwiftCheck. allows the pressure transducer to detect product line leaks at the rates of .1, .2 and 3 gph. A SwiftCheck. is not required if the STP is a Quantum. or CPT., both manufactured by Marley Pump (Red Jacket). See the photo in the manual of a Quantum. and CPT. submersible turbine pump. A SwiftCheck. can also be used with wireless line leak detectors (WLLDs) to test product lines to .1, .2 and 3 gph. If the SwiftCheck. is not present, the WLLD can only detect a leak of 3 gph or greater. Typically, the piston and spring in the STP functional element must be removed for correct operation. Note: If the STP is a F.E. Petro (painted blue) a SwiftCheck. is not required because of an internal, not visible, model R check valve which supercedes the use of the SwiftCheck. In addition, the internal check valve does not require disabling as does the Red Jacket functional element. See also Pressure Transducer.

Tank Capacity: the manufacturer's nominal tank size, when referring to a single tank.

Tank Field Well/Vapor Well: a monitoring well usually installed within the UST excavation backfill material used to monitor for vapors or for product if the water table is less than 20 feet below ground surface.

Tank Probe: part of an automatic tank gauging system. An electronic monitoring device capable of measuring product levels for inventory records and/or for leak detection purposes.

Turbine Pump: an electrically driven vaned pump submerged in the UST. Only pressurized systems use turbines, also known as submergible turbine pumps (STPs). The most common turbines used at gas stations are the 4-inch Extract, which is made by Marley (Red Jacket) and the F.E. Petro STP. Marley STPs are painted red and F.E. Petro STPs are blue.

Ullage: amount of space in a tank not filled by liquid.

Underground Storage Tank: any one or combination of tanks as set forth in Chapter 567--135 IAC including appurtenant pipes, lines, fixtures, and other related equipment, used to contain an accumulation of regulated substances, the volume of which, including the volume of the appurtenant pipes, lines, fixtures and other related equipment, is 10 percent or more beneath the surface of the ground.

Underground Storage Tank System or Tank System: an underground storage tank, its piping, and its associated ancillary equipment and containment system, if any.

Vent Pipe: a pipe that lets air enter an UST when product is dispensed and lets air/vapor exit an UST when product is delivered.

Volumetric Line Leak Detector: a mechanical line leak detector (also called a "lunchbox") manufactured by Veeder-Root. It is used on pressurized systems only and is connected by three lines to the submersible turbine pump (STP). It can detect leaks of 0.1, 0.2 and 3 gph. If a leak is detected, it stops the flow of product to the lines.

Waste Oil: including, but not limited to: used oil, motor oil, hoist oil and waste oil.

Wilco Simmons: a wireless tank monitoring system that consists of a battery-powered radar probe that measures product level in the tank, and a receiver located in the station office. The tank readings are sent by phone line to Texas where they are processed for SIR tank and line leak detection. This system is somewhat rare, but it may be seen more in the future.

WLLD: wireless line leak detector is an electro-mechanical device that monitors line pressure, and if a pressure drop is noted, the device turns off the submersible turbine pump (STP). Several different types exist and they test the line to 0.1, 0.2 and 3 gph. Common units are made by Veeder-Root and Incon.

Chapter 1: Compliance Inspections

Summary of Compliance Inspection Requirements

After meeting with stakeholders since winter of 2004, DNR's UST Section, in the spring of 2006, adopted regulations that require the inspection of regulated UST systems every two years by a licensed, private inspector. This is a significant transition for the DNR, which has relied on field office inspections since 1988.

The intention of going to a private inspector program over field office inspections was to solve a budget shortfall. It is expected that a regular two-year cycle of inspections will lead to improved operation and maintenance of UST systems and ultimately, fewer releases and better groundwater protection. This chapter introduces you to the compliance inspection requirements and procedures.

- **Existing UST systems.** An initial compliance inspection is required of all regulated UST sites no later December 31, 2007. All subsequent compliance inspections must be conducted within 24 months of the previous site inspection. Compliance site inspections must be separated by at least six months [135.20(1)].
- **New UST systems?** First time inspection for new UST systems registered after December 31, 2007 is within two calendar years after the date of registration (date 148 form signed).
- **Inspectors who are employed by UST system owners.** Final guidelines for inspections under the provisions of the 2005 Energy Policy Act do not allow employees to conduct inspections on UST systems that are owned by his/her employer.
- **Notification of the inspection.** The owner/operator is responsible for notifying the DNR of the compliance inspection date and the inspector's name 10 days before it takes place [135.20(2)].
- **What an inspection includes.** An inspection includes a physical assessment of the facility (leak detection equipment, spill and overfill devices, corrosion protection, sumps, pumps, dispensers, connections, fittings) and a thorough review of records (leak detection monitoring records, repairs, financial responsibility and equipment tests). The assessment of the UST system and records' review is a "snap shot" of compliance at that time. Any repairs or corrections after the inspection are noted as follow up.
- **Inspection report.** Certified inspectors must submit a copy of the inspection report to the owner/operator within 10 days of the inspection [135.20(2)]. The DNR receives an electronic copy of the inspection within 10 days after the inspection is completed.
- **Deficiencies.** Violations or deficiencies must be corrected within 60 days' receipt of the inspection report [134.14c(1)c].
- **Paperwork/records?** Owners/operators must be able to provide to the compliance inspector all the records and documents required by Chapter 567—135.
- **Reporting a release: suspected or confirmed.** If a release is confirmed or suspected by the compliance inspector, the inspector must inform the owner/operator to immediately report the condition to the DNR. The release will be included in the compliance inspector's report.
- **Cathodic protection testing.** An inspector is not required to conduct cathodic protection testing, but must check the CP test reports on file, and be knowledgeable about cathodic protection testing, corrosion and stray current. A compliance inspector is encouraged to conduct cathodic protection testing when a problem is suspected.

Summary of Inspection Details

Follow these steps on the year the inspection is due:

Step	Action	When	Why
1	**Owner contracts with Iowa licensed installer/inspector to conduct compliance inspection**	**Before December 31st 2007 and every two years thereafter**	**To meet UST compliance requirements**
2	**Inspector notifies DNR of inspection date**	**10 days before inspection**	**For tracking. May be audited by DNR**
3	**Conduct compliance inspection using DNR checklist. Photograph all deficiencies**	**Deficiencies are photographed in "as is" condition**	**For DNR and EPA regulatory compliance and tracking information**
4	**Provide owner/operator with copy of results of inspection**	**Within 10 days of the inspection**	**Compliance requirements**
5	**Provide DNR with electronic copy of inspection report**	**Within 10 days of the inspection**	**Compliance requirements**
6	**Deficiencies are discovered during the compliance inspection**	**Repairs/corrections must be made within 60 days**	
7	**Deficiencies may require subsequent or follow-up inspection**	**Within 60 days**	**To ensure owner has corrected deficiencies**
8	**Notify DNR electronically that site has resolved deficiency**	**Within 60 days**	**To complete inspection**
9	**Deficiencies not corrected**	**Within 60 days**	**DNR field office follow up including legal enforcement action**
10	**Inspection completed and deficiencies corrected. Inspection is audited and approved.**	**Within 60 days**	**Inspection requirements completed**
11	**Next Inspection**	**Within 24 months and no sooner than 6 months since the last inspection**	

How the Inspection Process Works

Tank Management Tags and Financial Responsibility: What you need to know

Tank management tags are first issued when an owner/operator registers the tank with DNR, usually a new installation. Before the tags are issued, the owner owner/operator must provide along with the registration form an approved method of pollution liability insurance, pay a registration fee and pay for the tags themselves. Annual tank management fees are $65 per tank or compartment, and are valid from April 1 to March 31 of the following year. Tanks 1,100 or fewer gallons receive a one-time silver tag that remains with the tank throughout its operation.

Beginning April 2007, all regulated tanks greater than 1,100 gallons will receive a purple tag which will remain with the tank until it is permanently closed. Each subsequent year, the DNR will issue a renewal tag that will remain attached to the fill port along with the purple tag. **NOTE**: Until the 2008 renewal tag is issued, the only tags attached to fill ports should be the purple tag (for tanks greater than 1,100 gallons), and the silver (for tanks equal to or less than 1,100 gallons). The purple tags allow the DNR to track each tank for compliance concerns as well as for any problems that may be associated with that tank. The number on the tag will match the number in the DNR database.

Each time you inspect an UST facility, you will look for a current tank tag on each fill port. If the tag is not present on the fill port, it is a violation (unless the tank is temporarily closed) even if the tag is in a drawer in the store. Tags must be affixed to the fill port and be visible to the transporter.

Current tags identify the tank as a regulated vessel, appropriate for transfer of a petroleum product. It is illegal for transporters to transfer fuel to an untagged tank [567--135.3(3)]. At new installations, the DNR will authorize a one-time delivery to tanks that have not been issued tags in order to conduct volumetric tightness testing on the tanks. Product may not be sold until the registration form is submitted, tank management fees are paid and insurance is obtained. Temporarily closed tanks should not have tank tags on the fill port, as they should not be receiving product. The UST Section will send tags for temporarily closed tanks after all the start-up requirements are met.

Tank tags identify tanks that may receive fuel, but also keeps transporters from transferring product to illegal tanks such as unregistered tanks, tanks without pollution liability insurance, and even monitoring wells! Those small aluminum tags protect groundwater, too. If a fill port is not identified with a tank tag, it's not a legal tank or an appropriate vessel; therefore, do not transfer product. Before you inspect a site, you will already know if the tank management fees are paid, and the insurance is current from your inspection checklist.

When you arrive for the inspection of the tank system, confirm that the current tank tags are affixed to the fill port and visible. If they are not there, find out where they are. Are they on the premises? If so, have the owner attach them to the fill port with you present. It is still a violation, but make note that it has been corrected.

If the owner/operator had the tank filled without tags attached, find out who delivered the product. A transporter can be issued a violation for delivering to a site without tags properly affixed. If the tank is unregistered (i.e., it is not identified on your checklist), find out why and contact the central office.

Financial Responsibility

Owners/operators of regulated UST systems cannot operate unless they have an approved insurance mechanism that provides coverage for a release and third party liability. When owners/operators apply for annual tank tags, DNR must have proof of financial assurance before tags will be issued. Financial assurance is renewed annually.

There are several mechanisms available, but the most common are insurance either through a certificate (such as PMMIC provides) or self-assurance (at least $10 million in tangible net worth) for large marketers or businesses. Only state and federal governments--whose debts and liabilities are the debts and liabilities of the state or United States--are exempt from financial responsibility requirements. Municipal and County governments must maintain financial responsibility just as private marketers.

Insurance must be maintained on an UST system for the life of that system even when temporarily closed. However, insurers will typically cancel coverage at a site if the UST system remains temporarily closed for over 12 months. The DNR requires closure-in-place sampling at a site that remains temporarily closed for more than 12 months. The closure-in-place sampling is necessary to determine whether a new release has occurred at the site before the eligibility to file a claim expires.

Photo 1: Lost diesel product and profits, plus a co-pay on an insurance claim.

Chapter 2: Preparing for the Compliance Inspection

This chapter covers a number of topics to help an inspector better prepare for some of the situations that might be encountered during an inspection, such as: what is a suspected release, is it reportable, and by whom.

- **Recommended Tools:** Suggested Equipment Needed to Perform a Typical Inspection. A selected list of items to bring to the job site.

- **Maintenance, Repairs, Upgrades:** What's the Difference? When an inspector comes across something that needs fixing, is it an upgrade, repair or just routine maintenance? The difference is important because the laws on reporting requirements vary. Learn the different requirements for each.

- **Reporting and Record Keeping Requirements:** Records are indispensable, especially if you are tracking down a suspected release. Find out what records need to be kept and for how long.
  - Required record keeping
  - Corrosion protection record keeping
  - Record keeping general repairs

- **Where Leaks Occur:** Iowa is yet to do its own study on where the leaks occur, but we expect that conditions in Iowa are not different from other states. Single wall systems are problematic according to most research. Spill buckets and joints in the piping system are major causes of releases.

- **Hazardous Conditions.** Inspectors may come across a tank system that is leaking or one that is acting suspiciously. Know what to look for, how to respond and whom to contact.
  - Confirmed and suspected releases
  - What to report and when
  - What needs to be done after a release is reported
  - DNR Field Offices and addresses

- **Ethanol**
  - High blend ethanol checklist
  - Dispenser inspection record

Recommended Tools for a Typical Inspection

The following is a list of equipment, materials, and tools that the DNR suggests an inspector have on hand prior to performing an inspection.

1. Source Materials

- ❑ DNR Compliance Inspector Manual and DNR Inspection Form
- ❑ National Work Group on Leak Detection Evaluations (NWGLDE)--list of leak detection evaluations for UST Systems, latest edition
- ❑ Blank 148 forms (registration) and other DNR forms as needed.

2. **Site Specific Information.** Review these before arriving on site:

- ❑ UST database tank report (tank information report). Learn as much as you can about the site before arriving. When the owner contacts you to arrange a date for the inspection, ask the owner to have the following records available at the time of the inspection (or sent to you prior to the inspection):
- ❑ Copy of the last tank or line tightness test
- ❑ Last 12 months of release detection records
- ❑ Last cathodic protection test results for steel tanks/piping
- ❑ Last annual automatic line leak detector test results if pressurized system
- ❑ Maintenance logs, calibration tests, invoices or records of repairs, cathodic protection log for impressed current cathodic protection systems (every 60 days), log for E85 non-compatible dispensers (daily).
- ❑ Previous inspection reports
- ❑ Copies of any spill reports

3. Basic Toolbox Items

- ❑ Folding tank gauge stick
- ❑ Long pry bar for manways
- ❑ Tape measure
- ❑ Tools (screwdrivers, adjustable wrenches, socket set, cordless power drill (for removing nuts to lids of containment sumps)
- ❑ Flashlight, marking pens, chalk
- ❑ Digital camera

4. Special Items for Cathodic Protection Testing

- ❑ Voltmeter
- ❑ Copper-copper sulfate Reference Cell
- ❑ Insulated connector leads (30+ feet)
- ❑ Alligator clips
- ❑ Water bottle

5. Safety Equipment

- ❑ Traffic safety cones
- ❑ Hard hats, gloves, boots
- ❑ Fire extinguisher, safety glasses, face shield, ear plugs

Maintenance and Repairs of UST Systems

All owners and operators of underground storage tank (UST) systems must ensure the tank systems are properly installed, maintained and repaired. Exactly who can do each of these tasks can differ slightly. This section will help UST inspectors understand the different requirements for each action.

1. Definitions

- Maintenance: The normal operational upkeep to prevent an UST system from leaking or releasing product [567--135.2]. Remember, a leak is a breech in the UST system where the petroleum product is contained (does not enter the backfill and contact soil or groundwater). A release is when the petroleum product enters the backfill or contaminates the environment.

- Repairs: After a leak or release has occurred: to correct or restore a tank, product piping or any part of an UST system that has caused the leak or release of product from the UST system [567--135.2].

2. Maintenance

- The owner or operator, a manufacturer representative, a general contractor, an Iowa Licensed Installer or Certified Compliance Inspector can do maintenance of an UST system. Maintenance includes those tasks essential to daily operation of the UST system such as cleaning spill buckets, adjusting overfill alarms, conducting monthly leak detection monitoring, changing filters and checking equipment for problems by opening covers, manways, etc. Owners may not, for example, install UST systems, submersible turbines, line leak detectors, leak detection equipment or conduct cathodic protection testing unless they are appropriately certified or licensed.

3. Repairs

Repairs mean fixing or correcting the UST system or any component that is the source of a leak or release. Owners and operators must ensure the following:

- An Iowa Licensed Installer, or Certified Compliance Inspector must perform or supervise any repair work. National Association of Corrosion Engineers (NACE) certified or comparable certified persons are the only ones who may test, install, and repair cathodic protection systems.
- Repairs must be conducted in accordance with national standards
  a. National Fire Protection Association Standard 30*, Flammable and Combustible Liquids* Code, 2003 Ed.
  b. American Petroleum Institute Recommended Practice 2200*, Repairing Crude Oil, Liquefied Petroleum Gas, and Product Pipelines*, third Edition, May 1994
  c. American Petroleum Institute Recommend Practice 1631, *Interior Lining of USTs*, Fifth Edition, June 2001
  d. National Fire Protection Association 326, *Standard for the Safeguarding of Tanks and Containers for Entry, Cleaning, or Repair*, 2005 Ed.
  e. National Fire Protection Association 329, *Recommended Practice for handling Releases of Flammable and Combustible Liquids and Gases*, 2005 Ed.
  f. National Fire Protection Association 30A*, Code for Motor Fuel Dispensing Facilities and Repair Garages*, 2003 Ed.
  g. Petroleum Equipment Institute, Recommended Practices for Installation of Underground liquid Storage Systems, PEI RP100.

h. American Petroleum Institute, Recommended Practice 1632, *Cathodic Protection of underground Petroleum Storage Tanks and Piping Systems*, 2002 Standard
i. National Association of Corrosion Engineers, Recommended Practice 02-85, *Control of External Corrosion on Metallic Buried, Partially Buried, or Submerged Liquid Storage Systems*
j. National Association of Corrosion Engineers Standard Test Method 0101-2001 Measurement Techniques Related to Criteria for Cathodic Protection on Underground or Submerged Metallic Tank Systems
k. Steel Tank Institute, Recommended Practice for the Addition of Supplemental Anodes to sti-P3® USTs, 2006 Ed.

- Repaired Equipment Tested: repaired tanks and pipes must be tightness tested within 30 days after repairs. Testing must be performed by a certified tester or Iowa Licensed Installer or Certified Compliance Inspector. Tightness testing is not required if:
  a. The repaired tank is internally inspected and
  b. The tank has automatic tank gauging, interstitial monitoring or statistical inventory reconciliation as a method of monthly monitoring [567--135.4(4)].

- Records Maintained: the owner or operator must keep records of each repair done for the remaining operating life of the system or component [567--135.4(5).

Reporting and Record Keeping Requirements

The Annual and Permanent Tank Management Tag must be affixed to the fill port of all regulated USTs where it will be readily visible [135.3(4)]. Regulated substances may not be transferred to tanks that do not have current tank management tags.

Underground storage tank systems are inspected every two years to ensure they are operating within the technical requirements of Chapter 567--135 IAC. A thorough inspection of a facility requires the availability of records, such as release detection monitoring results, cathodic protection test results and any UST equipment repairs. Records may be kept at an off-site location and provided to the department upon request [567--135.4(5)]. The department allows a minimum of two working days to submit records if they are not immediately available.

Release detection monitoring records are indispensable in determining whether a release has occurred at a site. If the records are not immediately available, they must be submitted within two working days. If the matter is not urgent, you may allow more time for record submittal.

The following records must be reported (submitted) to the department [135.4(5)], and may or may not be part of your inspection (e.g., corrective action plans, etc). It may not be necessary to ask the owner for required reporting records as these records may have been already submitted to the department.

The UST database or Tank Report that you take with you in the field will confirm whether the department has the current information. If the information is not current, make the changes on your inspection report checklist; or if they are serious omissions or corrections (e.g., new piping), have the owner/operator submit a revised 148 form.

Required Reporting

Notification Records to be submitted/reported to the department:

1. Installation Notification form [135.3(3)"h"]
2. Registration (148) form [135.3(3)"a"
3. Temporary Closure form (if applicable)
4. Notification of Permanent Closure or Change in Service form

All owners and operators of new UST systems must certify in the Registration form compliance with the following requirements:

1. Installation of tanks and piping under 135.3(1) "e"
2. Cathodic protection of steel tanks and piping under 135.3(1) "a" and "b"
3. Financial responsibility under Chapter 136
4. An approved method of release detection monitoring under 135.5(2) and 135.5(3)

All owners and operators of UST systems must report to the department:

1. **All releases including suspected and confirmed releases [135.6(1)]**
2. **Spills/Overfills (135.6(4)**

Following the reporting of a release, owners and operators must report

1. **Corrective actions planned or taken including**
2. **Initial abatement measures [135.7(3)]**
3. **Initial site characterization [135.9]**
4. **Free product removal [135.7(5)]**
5. **Investigation of soil and groundwater cleanup and corrective action plan [135.8 to 135.12]**

Required Record Keeping

Remember: Any records not maintained onsite must be made available upon request [135.4(5) "c"]

1. **Tank system owners and operators must maintain records in accordance with 135.5(4). These records include the following:**

    a. **The owner/operator shall, on a monthly basis, keep a record documenting the results of all monthly release detection monitoring and any maintenance checks performed. This may include a printout or a written (if no printer is available) log from an Automatic Tank Gauging system, a monthly log for inventory control/manual tank gauging or a report from a Statistical Inventory Reconciliation (SIR) vendor summarizing the results of each months record keeping. If vapor or groundwater monitoring is used for monthly leak detection monitoring, a written monthly log is used [135.5(6)].**

b. The owner/operator must maintain records of the performance claims pertaining to any release detection system used. *These records must be maintained for five years from the date of installation.*

c. The owner/operator shall maintain all records relating to the calibration, maintenance and repair of any release detection system used on-site. *These records must be maintained for at least one year after the service work is completed.* If an Automatic Tank Gauge is used for leak detection, records must be available documenting when the system was last checked for calibration (according to the manufacturer's specifications) by an UST technician. *Schedules of required calibration and maintenance must be maintained for five years.*

d. Records must be available documenting that all automatic line leak detectors for pressurized systems have been checked at least once a year by an UST technician according to manufacturer's specifications [135.5(6) "b"].

2. Records shall be available documenting the results of all tightness tests conducted as part of a facility's leak detection requirements, including:

a. Annual line tightness testing for pressurized systems must be available if monthly monitoring of the line is not conducted. The tightness test must meet a minimum 0.1 gallon per hour leak rate. *Maintain records at least until the next test*.

b. A line tightness test every three years for suction systems if monthly monitoring of the line is not conducted. The tightness test must meet a minimum gallon-per-hour leak rate. *Maintain records at least until the next test.*

c. A tank tightness test every five years when inventory control or manual tank gauging is used. The tightness test must meet a minimum 0.1 gallon-per-hour leak rate. *Maintain records at least until the next test.*

Corrosion Protection Record Keeping [135.3(1)]

For steel UST systems, the owner/operator shall maintain records, including:

1. Documentation of a corrosion expert's analysis of the site corrosion potential if corrosion protection is not used [135.3(1) "a" (4) 2.]

2. Documentation of operation of the UST system corrosion protection equipment, including:

a. All cathodic protection systems shall be tested within 6 months after installation and at least every three years thereafter by a qualified cathodic protection tester [135.4(2) "b" (1)]. *Maintain results of last two inspections*.

b.* With UST systems that have an impressed current cathodic protection system, the rectifier must be inspected every 60 days to ensure it is operating properly [135.4(2) "c"-"d"]. *Maintain results of the last three inspections.

c. If an UST is lined for corrosion protection, records must be available documenting when the UST was lined and the results of any internal inspections required 10 years after the lining and every 5 years thereafter. *Maintain records for the life of the tank*.

Record Keeping General Repairs [135.4(4)]

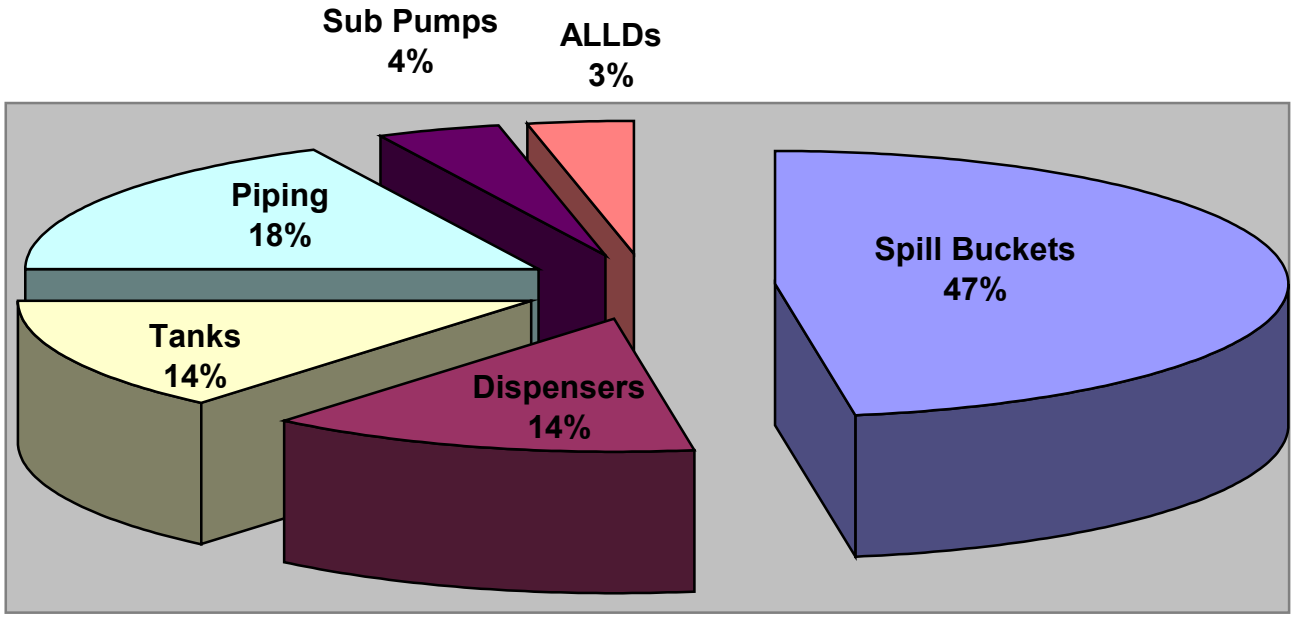
Records for the following repairs must be maintained for the remaining operating life of the system [135.4(4) “f”]:

1. **All repairs shall be conducted in accordance with a nationally recognized standard and/or in accordance with the equipment manufacturer's specifications [135.4(4)].**

2. **Repaired tanks and piping must be tightness tested within 30 days following the repair. Records documenting the repair and tightness test by a certified UST contractor shall be available for inspection [135.4(4) “d”].**

3. **Cathodic protection systems must be tested within 6 months following a repair of the system [135.4(4) “e”].**

UST System Leak Sources



According to a March, 2006 study completed by the Florida Department of Environmental Quality, spill buckets were responsible for almost half of the of reported leaks (159 out of 373) in the state. Iowa's experience is similar to Florida's. Spill bucket connections and damaged spill bucket (cracks or holes in the plastic spill buckets and corrosion in metal spill buckets, and separation from the fill pipe) lead to releases. Double-wall or secondary containment for spill buckets is a good idea in light of these findings.

Other areas where problems occur in the form of vapor and liquid phase releases:

- **Automatic Tank Gauge access riser caps and signal cable penetrations**
- **Piping: material failure, loose connections, punctures**
- **Dispenser (fittings, gaskets, seals)**
- **Spill bucket drain valves (significant vapor releases)**
- **Improper joints, improperly seated rings and gaskets, moving joints while curing**
- **Threaded fittings, fiberglass reinforced plastic (FRP) to steel, scarred threads from bad dyes**
- **Bruised or crimped piping**
- **Flex connectors**
- **Shear Valves**
- **Product transfer/deliveries**

Notification of Hazardous Condition

Iowa Administrative Code Chapters 131 and 135.6(4)

It is not uncommon to spot a leak or a release during your inspection. This section explains how to handle the situation, what the difference is between a hazardous condition (reportable immediately/within six hours) and non-hazardous condition. Petroleum is a hazardous substance; and when you have a leak or release at a busy petroleum marketing facility, a hazardous condition is not hard to determine. Any spill or overfill must be evaluated in terms of a hazardous condition, rather than using amount of gallons spilled. Department rules stress the immediate or potential danger that a spill may cause.

If you as an inspector observe a leak, report it to the owner immediately. The owner has the responsibility of reporting the leak/release to the DNR. The inspector can assist the owner/operator in determining whether the condition is hazardous. Here is the definition of a hazardous condition followed by some examples.

Definitions

"Hazardous Condition" means any situation involving the actual, imminent or probable spillage, leakage, or release of a hazardous substance onto the land, into a water of the state or into the atmosphere which, because of quantity, strength and toxicity of the hazardous substance, its mobility in the environment and its persistence, creates an immediate or potential danger to the public health or safety or to the environment.

Hazardous Substance means any substance or mixture of substance that presents a danger to the public health or safety and includes, but is not limited to, a substance that is toxic, corrosive, or flammable, or that is an irritant or that, in confinement, generates pressure through decomposition, heat, or other means.

Here are just a few examples of hazardous conditions that must be reported immediately:

- Petroleum is spilled and runs across the concrete or asphalt and has potential to reach or has reached the storm sewer/sanitary sewer. This can cause an explosion in the buildings connected to the sewer and in the wastewater treatment plant or the lift station
- Petroleum is spilled at dispenser or high traffic area and creates a potential fire hazard or threat to public safety
- Petroleum vapor gets into utility conduits or nearby buildings which can cause toxic or explosive conditions
- Petroleum has the potential to reach a water of the state – either surface or groundwater
- Local officials (Hazmat/Fire/Police) respond to the incident or assistance is needed to clean up the spill/overfill
- Petroleum can be detected in the air at the boundaries of the facility by the senses (sight/smell)
- The petroleum release exceeds the reportable quantity (25 gallons)

Confirmed or Suspected Releases

Iowa Administrative Code 135.6

If you observe any of the following conditions, report it to the owner/operator as a confirmed or suspected release, and tell him/her to report it to the DNR:

- Presence of free product (liquid petroleum) in a sump or monitoring well
- Soil contamination
- Surface or groundwater contamination
- Petroleum vapors in sewer, basement or utility lines (hazardous condition)
- Sudden loss of petroleum indicated through release detection records/methods
- Unexplained water in the tank/piping
- If the results of leak detection monthly monitoring show a release, or
- Erratic behavior of the dispenser; leak at dispenser without a containment sump.

<u>You do not need to report a suspected release to the DNR if</u>:

- The monitoring device reporting the suspected release is found to be defective and is immediately repaired, calibrated or replaced, and
- Additional monitoring does not confirm the initial result of a release.

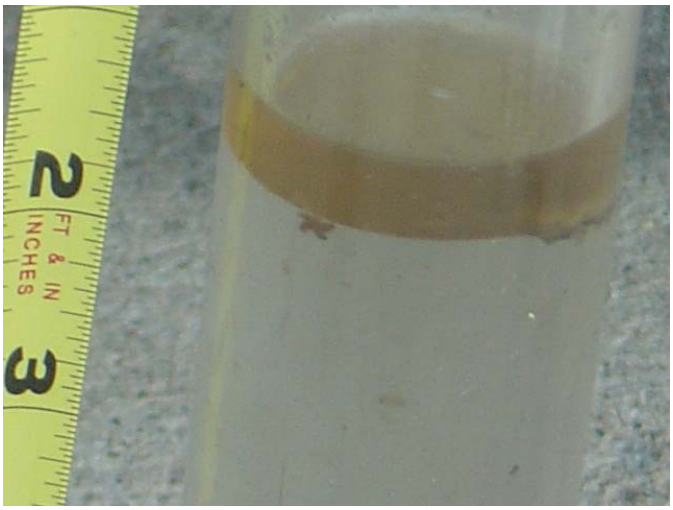


Photo 2: About 3/8" of free product on groundwater retrieved with a bailer.

Photo 3: Same site with sheen on water in the STP sumps

To further clarify what is reportable, to whom to report, and how soon to report it, see below:

What to Report and When		
What You Discover	**When Owner Must Report to DNR**	**Whom to Contact**
Above ground release to soil (Any release of 25 gallons or less not immediately cleaned up)	Within 24 hours unless a hazardous condition exists and then within 6 hours	Emergency Response
Any release of 25 gallons or greater	As soon as possible, but no later than 6 hours after onset or discovery	Emergency Response
Below ground release of any amount	As soon as possible, but no later than 6 hours after onset or discovery	Emergency Response
Above ground release to waters of the state that cause sheen	As soon as possible, but no later than 6 hours after onset or discovery	Emergency Response
Any unusual operating conditions ❑ The presence of free product (liquid petroleum), soil contamination, surface or groundwater contamination, or petroleum vapors in sewer, basement or utility lines ❑ Erratic behavior of the dispenser ❑ Sudden loss of petroleum ❑ Unexplained water in the tank/pipe	Within 24 hours unless a hazardous condition exists and then within 6 hours. A hazardous condition exists if the spill or release *creates an immediate or potential danger to the public health or safety or to the environment* [567--131.1]	Emergency Response
Any release detection results that indicate a release (e.g., *Fail*) may have occurred.	Within 24 hours unless additional monitoring does not confirm the initial release or defective equipment thought to have caused the release is repaired/replaced	DNR/UST Tank Section
Two consecutive months of an *Inconclusive* result on SIR, ATG systems or Inventory Control monthly release detection	Within 24 hours	DNR/UST Tank Section

Contacts in the Event of a Known or Suspected Release Based on Location of Incident			
Contact	**Location**	**Phone/Fax**	
24 Hour Emergency Response	Des Moines	515.281.8694	515.725.0218
Field Office 1	Manchester	563.927.2640	563.927.2075
Field Office 2	Mason City	641.424.4073	641.424.9342
Field Office 3	Spencer	712.262.4177	712.262.2901
Field Office 4	Atlantic	712.243.1934	712.243.6251
Field Office 5	Des Moines	515.725.0268	515.725.0218
Field Office 6	Iowa City	319.653.2135	319.653.2856
Central Office, UST Section	Des Moines	515.281.3634	515.281.8895
WHEN IN DOUBT, REPORT IT!			

What needs to be done after a release is reported?

When an owner/operator reports a release to Emergency Response, they will be instructed in the actions to take to prevent any further release. Emergency Response will report the release to the UST Section (central office) and to the field office in the region where the release occurred. The central office and field office handle follow-up activities. If ever you have a question, contact either the field office in the region where you are working or the central office.

1. Instruct the owner to stop using the equipment. If an active leak is discovered during the inspection, instruct the owner/operator to stop using the equipment, such as an STP or tank that is causing the release or making it worse. Indications of a release could include a sump with product, a leak in the piping at the dispenser, a slow flow automatic line leak detector or evidence from leak detection monitoring results. Instruct the owner to empty the tank if a release is suspected from the tank itself, and bag the nozzle.

2. Determine the environmental impact. The next step is to determine, if possible, whether the leak is actually a release and has affected the soil and/or groundwater at the site. The presence of sumps and dispenser pans does not guarantee the product is not reaching the environment. This situation is called a "suspected release". The owner/operator may be required to conduct a site check (see 135.6(1-3) or Tier 1/Tier 2 if all indications are a release has occurred. Monitor and mitigate any fire and safety hazards posed by vapors or product.

If monitoring wells are present, check them for free product with a two-inch bailer or interface probe. Look for a sheen or free product in the bailer. If product is discovered in monitoring wells where it hadn't been before or if an increase in free product has occurred in the monitoring well, it may be a new release. Contact the LUST coordinator if you have a question about monitoring well values at active LUST sites.

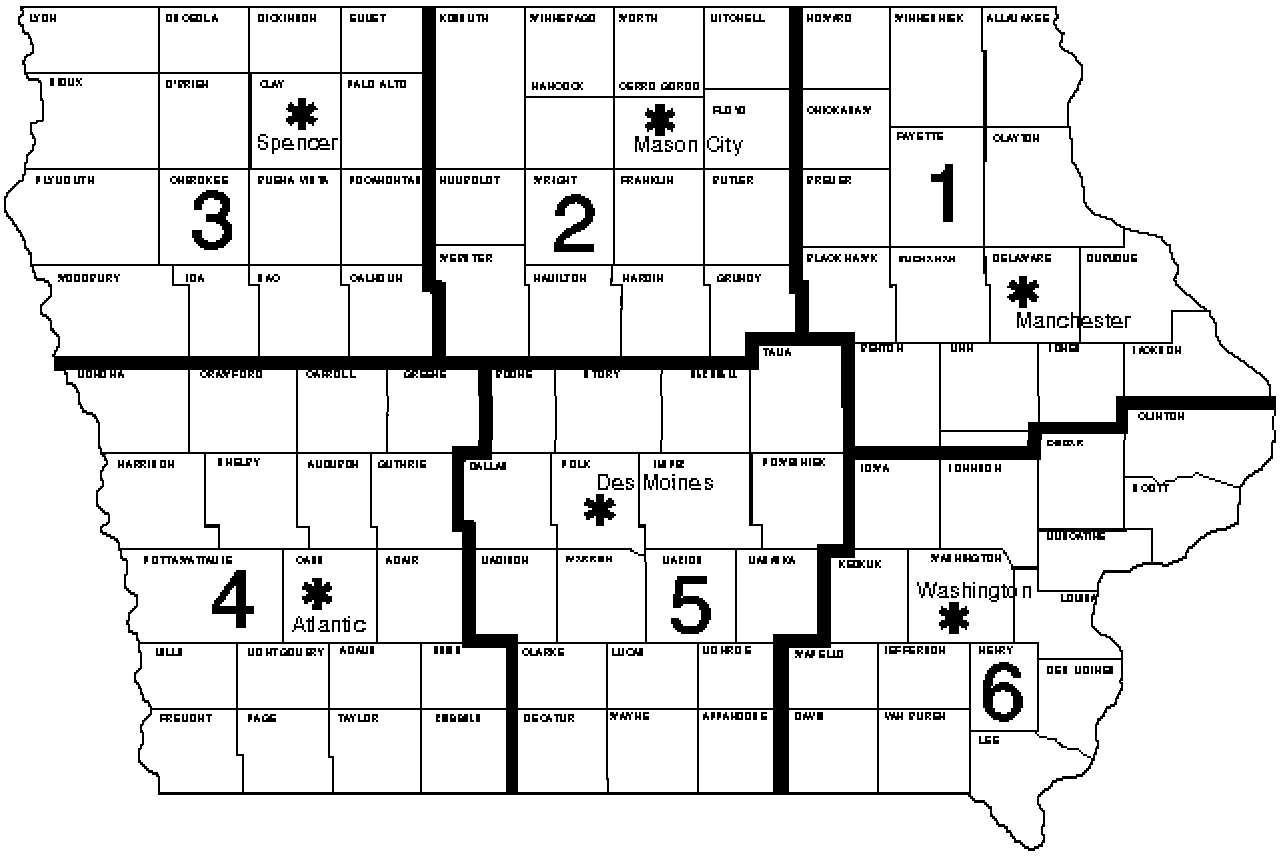
3. Containing spills. Kitty litter, floor dry, oil dry, agricultural lime or absorbent pads, pigs or booms can be used to contain small spills. Booms and pads are reusable. Wring fuel out to recycle fuel. Dry booms and pads in the sun on plastic sheeting. Kitty litter, oil dry, floor dry can be spread on a concrete or asphalt spill to absorb the fuel, placed into a bucket and spread out to dry on a sunny day. After it is dried, collect it and put it in a dumpster. Keep oil-soaked products separate from other waste, and check with the landfill to see what special requirements they have.

4. The owner should immediately notify the insurance company that insures the UST system. The insurance company will want to know as soon as a release is suspected or confirmed. They may also want to conduct their own investigation.

5. Investigate to determine the presence of free product (liquid petroleum). If a release occurred and free product is present, the owner/operator must begin free product recovery as soon as practicable and in accordance with 567--135.7(5).

6. Owner/operator must have UST system (cause of leak) repaired/replaced and tightness tested. The owner will receive a letter from the DNR Central Office requiring documentation that the system is repaired/replaced and tight.

DNR Field Offices and Addresses



Field Office 1
909 W Main, Suite #4
Manchester, IA 52057
Phone: 563.927.2640
Fax: 563.927.2075

Field Office 2
2300 15th Street SW
Mason City, IA 50401
Phone: 641.424.4073
Fax: 641.424.9342

Field Office 3
1900 N Grand, Suite E17
Gateway North Mall
Spencer, IA 51301
Phone: 712.262.4177
Fax: 712.262.2901

Field Office 4
1401 Sunnyside Lane
Atlantic, IA 50022
Phone: 712.243.1934
Fax: 712.243.6251

Field Office 5
401 SW 7th, Suite 1
Des Moines, IA 50309
Phone: 515.725.0268
Fax: 515.725.0218

Field Office 6
1023 West Madison
Washington, IA 52353
Phone: 319.653.2135
Fax: 319.653.2856

Ethanol

Ethanol and other renewable fuels have increased in demand. The problem is that ethanol blends greater than 10 percent cannot be stored in UST systems optimized for petroleum products due to compatibility problems.

UST rules require the UST equipment and components to be compatible with the product stored (see 567--135.4(3) and NFPA 2.2.2). Components and equipment used for storing/dispensing conventional fuels are time tested for compatibility and readily available. High ethanol blend fuel does not have the same compatibility characteristics of conventional fuels when it comes to storage and dispensing. Soft metals such as zinc, brass or aluminum, which are commonly found in conventional fuel storage and dispensing systems, are not compatible with E85.

Some nonmetallic materials may also degrade when in contact with ethanol such as natural rubber, polyurethane, adhesives (used in older fiberglass piping), certain elastomers and polymers used in flex piping, bushings, gaskets, meters, filters, and materials made of cork. In order to store and dispense E-Blend fuel, fiberglass and steel UST systems/components must be compatible. For more information about compatibility and converting existing UST systems to E85, see the DNR's Ethanol website:
http://www.iowadnr.com/land/ust/technicalresources/ethanol.html.

E85 compatible tanks, piping, turbines, flex connectors, fittings, couplings, etc. currently exist; but there does not exist, at least at this writing, a UL-marked dispenser compatible with E85. Therefore, in order to make storing and dispensing E85 available for owners/operators, the DNR along with the State Fire Marshal, allows the use of conventional dispensers to dispense E85 until July 1, 2009, at which time a compatible dispenser should be available.

There are environmental and public safety risks involved in using incompatible UST equipment, which is why the DNR requires compatible equipment (documented by UL listing or the manufacturer's approval). An E85 checklist, completed by an Iowa licensed installer, is required for all sites that store and dispense high blend ethanol. The checklist should be available on site; if not, ask the owner if they completed one. If the owner/operator has not completed the checklist, tell him/her to have an Iowa licensed installer complete it and send you a copy. They have 60 days to comply. After it is completed and sent to you, forward a copy of the checklist to the DNR.

Make certain the dispenser for an E85 UST system is inspected daily. An inspection log is included in this manual following the checklist on the next page.

Biodiesel begins to show compatibility problems in blends higher than B20. Concentrations of 20 percent or lower do not need to complete a checklist.

Underground Storage Tank System Checklist for Equipment Compatibility

with E-blend Fuels (greater than 10% ethanol by volume)

This checklist is to be completed by the owner/operator and an Iowa Licensed Installer. In place of an Iowa Licensed Installer, an owner/operator may use a professional engineer's judgment who has knowledge, experience and training in materials science (API, RP 1626, p. 1.4) to determine the suitability and compatibility of materials/equipment/components with E-blend fuels. In such a case, the Professional Engineer would complete the checklist and sign it. The owner must complete those items identified as the owner's responsibility in the checklist.

Facility Name	**Registration No.**
Address	**No. of Tanks**
City, County, Zip	**Date of Inspection**
Owner Name	
E-blend stored ☐ E-85 ☐ Other:	
IA Licensed Inspector or Professional Engineer	**IA License No.**

Company Name	**Address**
City, Zip	**Phone**

The UST system components below must be compatible with the E-blend fuel stored and dispensed (see asterisks for thread sealant and adhesive). Review this checklist thoroughly for its requirements before converting to E-blend fuel. Enter *Model/Brand*, *Manufacturer* and check either Yes or No in one or both columns under *UL Listed* or *Manufacturer Approved*.

Table 1: Tanks and Product Piping

Component	Model/Brand	Manufacturer	UL Listed	Manufacturer Approved
Tank* (capacity):			Yes ☐ No ☐	Yes ☐ No ☐
Auto Shutoff			Yes ☐ No ☐	Yes ☐ No ☐
Sub Pump, O-rings, Gaskets			Yes ☐ No ☐	Yes ☐ No ☐
Tank Sump			Yes ☐ No ☐	Yes ☐ No ☐
ATG Probe, float/sensor			Yes ☐ No ☐	Yes ☐ No ☐
Ball Float			Yes ☐ No ☐	Yes ☐ No ☐
Sump Sensor			Yes ☐ No ☐	Yes ☐ No ☐
Pipe			Yes ☐ No ☐	Yes ☐ No ☐
Thread Sealant**			Yes ☐ No ☐	Yes ☐ No ☐
Adhesive**			Yes ☐ No ☐	Yes ☐ No ☐
Flex Connectors			Yes ☐ No ☐	Yes ☐ No ☐
LLD			Yes ☐ No ☐	Yes ☐ No ☐

***Internally lined tanks are not suitable for conversion to storage of E-blend fuels. ** If compatibility is undetermined, analysis may be used to determine compatibility. Deadline for determining compatibility is 1 July 2007. Third party precision line testing required annually.**

Dispensers and Dispenser Sumps

The DNR and Fire Marshal Division require dispensers to bear the UL Mark or listed by another independent testing laboratory. Currently there are no E-blend compatible dispensers with a UL Mark. In the fall of 2005, the DNR, the Fire Marshal Division and the ethanol industry worked out an agreement wherein dispensers that comply with NFPA 30A for dispensing E10 may be used to dispense E85. The agreement was intended to facilitate the dispensing of E85 in Iowa while providing for the safety of customers and facilities. The agreement allowed for a two-year phase in of dispensing equipment, until July 1st, 2007 when it was believed UL Marked dispensers would be available. During the 2006 session of the Iowa General Assembly, the enactment of 2006 Iowa Acts, House File 2754 extended the date by which listed equipment will be required for dispensing E-85 to July 1, 2009. All UST systems that store and dispense E-blend fuel after July 1, 2009 must be fully compatible.

Owners and operators must check E-blend dispensers daily for leaks and equipment failure. Any component of the dispenser that leaks or does not operate as designed due to exposure to E-blend must be removed and replaced with compatible components. Notify the DNR immediately (515.281.8879 or 515.281.8779) of the failed component. Each daily check of the dispenser is to be recorded on the DNR's form: (http://www.iowadnr.com/land/ust/technicalresources/documents/ethanolinspect.doc).

The inspection record must be completed by the owner/operator or someone authorized by the owner/operator and knowledgeable about the inspection requirements. The inspection record should be kept on site where possible or available for submittal to the DNR within two working days.

If an owner/operator discontinues storing and dispensing E-blend fuel and switches back to gasoline before buying E-blend compatible dispensers, daily visual inspections of the dispenser must continue for six months after converting. Owner/operators must also continue to keep a record of the inspections on the DNR's daily inspection form.

Table 2: Dispensers and Dispenser Sump

Component	Model/Brand	Manufacturer	UL Listed	Manufacturer Approved
Dispenser			**Yes ☐ No ☐**	**Yes ☐ No ☐**
Pipe sealant*			**Yes ☐ No ☐**	**Yes ☐ No ☐**
Seals/Gaskets			**Yes ☐ No ☐**	**Yes ☐ No ☐**
Suction Pump			**Yes ☐ No ☐**	**Yes ☐ No ☐**
Hoses			**Yes ☐ No ☐**	**Yes ☐ No ☐**
Nozzle/Swivel			**Yes ☐ No ☐**	**Yes ☐ No ☐**
Break-away			**Yes ☐ No ☐**	**Yes ☐ No ☐**
Filter			**Yes ☐ No ☐**	**Yes ☐ No ☐**
Meter			**Yes ☐ No ☐**	**Yes ☐ No ☐**
Dispenser/Sump				
Pipe			**Yes ☐ No ☐**	**Yes ☐ No ☐**
Pipe Sealant*			**Yes ☐ No ☐**	**Yes ☐ No ☐**
Flex Connector			**Yes ☐ No ☐**	**Yes ☐ No ☐**
Sump			**Yes ☐ No ☐**	**Yes ☐ No ☐**
Emergency Valve**			**Yes ☐ No ☐**	**Yes ☐ No ☐**
Sensor			**Yes ☐ No ☐**	**Yes ☐ No ☐**
Check valve			**Yes ☐ No ☐**	**Yes ☐ No ☐**

*** If compatibility is undetermined, analysis may be used to determine compatibility. Deadline for determining compatibility is 1 July 2009. Third party precision line testing required annually. **Emergency/Shear Valve must be compatible with E-blend fuels.**

Before E-blend is Transferred to the Tank

Once equipment compatibility has been established, the items below must be completed before E-blend fuel can be transferred to the tank. Items that are the responsibility of the UST owner are indicated. The remaining items are the responsibility of the Iowa Licensed Installer or Professional Engineer.

☐ Inform the facility's UST insurance carrier of plans to convert to an E-blend fuel. The UST insurance carrier may have additional requirements other than what the DNR requires. **(Responsibility of Owner)**.

☐ Obtain an amended certificate of insurance indicating UST coverage for the E-blend stored and dispensed. **(Responsibility of Owner).**

☐ Check for water in the tank. No level of water is acceptable for E-blend fuels due to the phase separation problems. **(Responsibility of Installer initially and the owner thereafter.)**

☐ All visible fittings and connections at the top of the tank are tight (no vapors escape and no water enters).

☐ Sump and spill containment covers prevent water from entering**. (Installer)**

☐ Water infiltration problems fixed if necessary.

☐ The tank has been cleaned of all water and sediment.

☐ Clean tank certificate obtained or comparable documentation (e.g., see API Publication 2015, Cleaning Petroleum Storage Tanks and NFPA 326, Standard for the Safeguarding of Tanks and Containers for Entry, Cleaning, or Repair, 199 Edition). **(Responsibility of Owner)**

☐ Labeling: identify the fill port and paint access covers according to API RP 1637. Make sure transport driver cannot make the mistake of delivering E-blend fuel to the wrong fill pipe. Label dispenser.

First Delivery

☐ Tank filled to 80 percent capacity (recommended by the Renewable Fuels Association or RFA) and kept as full as possible for 7 to 10 days. **(Responsibility of Owner)**

☐ Conduct a precision test of the tank system (0.1 gph leak rate) with ATG system within seven days after tank is filled to make sure system is tight and leak detection equipment is operating properly. Report any "Fail" results. **(Responsibility of Owner)**

☐ Test for water (use alcohol compatible paste if you stick your tanks) at the beginning of each shift for the first 48 hours after delivery (RFA). If there is water in the tank, remove it, find out how it got there and fix it so it doesn't occur again. **(Responsibility of Owner)**

☐ Check for water daily with your stick or ATG system if product seems to pump slow, check and replace filters. **(Responsibility of Owner)**

☐ Informed and demonstrated to owner/operator on how to visually inspect the E-blend dispenser for leaks and problems and on how to complete daily inspection record.

☐ Ethanol Compatibility Checklist signed by the Iowa licensed installer or Professional Engineer (e.g., with knowledge and training in materials science) and tank owner and submitted to the DNR by the UST owner. Include a copy of the revised certificate of insurance and the *Clean Tank Certificate* or comparable document with the checklist. **(Responsibility of Owner)**

Ongoing Maintenance

☐ Check regularly for water. No level is acceptable. **(Responsibility of Owner)**

☐ Calibrate the dispenser liquid meter at the time of conversion and at two weeks after conversion to verify meter accuracy. Particulate materials in the product may cause excessive wear of the meter, which would require more frequent calibration (API RP 1626).

☐ Conduct daily, visual inspections of the dispenser and dispenser sump (secondary containment) beneath the dispenser (if one is installed) and all the other items in the inspection record. The record should be kept on site where possible and available for submittal to the DNR within two working days. **(Responsibility of Owner)**

Installer Certification

I have inspected the visible UST system components, and reviewed available installation records of the UST site referenced on pages 1 and 2 of this checklist. I have found the information listed on the above checklist regarding the equipment/components of this UST site to be true and accurate. ☐ **Yes** ☐ **No**.

Signed _____, **Date** _____

☐ **Iowa Licensed Installer** ☐ **Professional Engineer.**

Owner's Signature: _____ **Date:** _____

Licensed Installers/Professional Engineers: Please comment on what equipment was needed to make the fuel path compatible with the E-blend used or why the site is not compatible for E-blend fuel

Daily Record of Visual Inspection for Incompatible Dispenser Components

Dispensers that are not certified by the manufacturer or UL Marked as compatible for E-Blend fuel may be operated with E-Blend fuel if a daily visual inspection is conducted by the owner/operator. The components below must be visually inspected for leaks and equipment failures. Any component that leaks or does not operate as designed must be replaced with a compatible component. Contact the DNR immediately if you observe a leak or failure (515.281.8879 or 515.281.8779). Record your daily inspections on this form either electronically or on paper. Retain inspection records for one year. The record of your daily visual inspections must be kept on site where possible or available for submittal to the DNR within two working days. If a leak is found, write LEAK in the box. For no leak, put an X in the box.

Day	Seal/ Gaskets	Filter	Suction Pump	Hoses	Meter	Break-away	Nozzle/ Swivel	Dispenser Sump Dry? Y/N	Pipe Joints	Flex Connector	Shear Valve	Check Valve	Inspector
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													

Ethanol inspection form 7.6.05

Chapter 3: UST Compliance Pre-Inspection

Pre-Inspection Procedures

This manual outlines the new UST Inspection database. The new inspection database is based on the compliance inspection form. The compliance inspection form represents a checklist of compliance items. Each section is broken down into its essential components (i.e., what you need to observe and evaluate). If the site is using an ATG system for leak detection monitoring, the form takes you through each of the compliance items essential for that method to pass that part of the inspection.

Each of you will be assigned a user name and password to access the UST Inspection database where you will enter the information from the compliance inspection form or you can enter the information from the field with your laptop computer.

The tank identification numbers are the permanent purple tags attached to each compartment. You will need to verify and enter these numbers for the initial inspection. For future inspections, these tanks will use the permanent number assigned.

To simplify data entry, the fields in the UST Inspection database default to "Yes". Checking "No" indicates a violation and will be noted on the final summary page of the compliance report. Drop-down boxes provide choices whenever possible. The inspection is populated with the information contained in the UST Inspection and UST/LUST databases. The only information you should have to change or enter is anything that has changed from the last inspection.

Schedule Inspection

The owner/operator will contact you to arrange for the inspection. Explain the inspection procedure. Encourage the owner/operator to be present during the inspection. Inspections are most effective when the owner/operator is present. It is a great way to promote good operation and maintenance of an UST system. You may also have questions for the owner/operator.

1. **Papers Ready.** Ask the owner/operator to have ready any and all paperwork on the UST system (see *Site Specific Information* on page 23 for a list of documents to have ready). The owner/operator must have records available on site or within three working days; therefore, call in advance (you may request copies be submitted to you prior to inspection). The more preparation you put into an inspection, the more time you will save afterwards. The most common problem with inspections is that records are not available, especially leak detection records. Make sure 12 months worth of leak detection records will be available, organized and ready for your review. You are not expected to sift through a shoebox of records. If that's how they're submitted to you, you may ask the owner/operator to organize them starting from the beginning of the 12 month period, only one printout required per month with the tank tested at the highest product volume and send them to you.
2. **Tank Report or UST System Report.** Describe to the owner/operator what records you will need and to have them available by the time of the inspection. Tell the owner/operator you will need access to the entire UST system (all sump lids, covers, hatches). Before inspecting a facility, check the site on the registration database and print the tank report or UST system report. Check to ensure the information on the tank report is current when you conduct the inspection.

3. **Registration Information.** The tank report or UST system report will inform you if financial responsibility is current or if the site has any outstanding compliance issues (violations/ deficiencies). The database will indicate the date of the last inspection and the leak detection equipment used on site. The database information can be the basis for a successful inspection. However, it is only as accurate as the last inspection or information supplied by the owner/operator. If significant inaccuracies are found during the inspection, the owner/operator must submit corrected information to the department on a 148 or registration form. All tank information is public, so feel free to come to the Wallace Bldg. for more information about a site.
4. **Report Submittals.** It is the responsibility of the compliance inspector to submit the inspection report to the owner and an electronic copy of the inspection report to the DNR within 10 days of the inspection.

Get a Complete Facility Report On-Line

UST DATABASE

The information from the inspection is stored in the UST/LUST database. A tank report is available to review when preparing the inspection.

Iowa Department of Natural Resources
Underground Storage Tank Section

TANK INFORMATION REPORT 7/2/2007

Registration 198600000 **Facility Name** CASEY'S GENERAL STORE #2784 **Owner Name** CASEY'S MARKETING CO

LUST Number(s) **Facility Address** 4151 MERLE HAY RD **County** 77 Polk

Facility City Des Moines **Field Office** 5 **Site Status** 4

Last Date Inspected

Tank/Compartment Number	Status	Tank Type	Installed	Removed	Total Capacity	Content	Tank Material Construction
26	4	Retail Sales	08/01/1999		12000	Gasoline	Double Wall Composite
27	4	Retail Sales	08/01/1999		12000	Gasoline	Double Wall Composite
28	4	Retail Sales	08/01/1999		12000	Gasoline	Double Wall Composite

Financial Assurance/Spill Protection/Type Of Piping

Tank Number	Financial Assurance	Spill Protection	Pressurized Piping	Suction Piping	Safer Suction Piping
26	PMM Insurance Company	X	X		
27	PMM Insurance Company	X	X		
28	PMM Insurance Company	X	X		

INTERNAL & EXTERNAL PROTECTION/LEAK DETECTION SYSTEM

Tank Number: 26

Tank External Protection

Cathodic Protection	
Field Installed Cathodic Protection	
Factory Installed Cathodic Protection	
Impressed Current Cathodic Protection	
Painted or Asphaltic Coated	
Fiberglass Reinforced Plastic Coated (FRP)	X
Factory Applied Coal Tar Epoxy Coated	
Fiberglass Reinforced Urethane Coated (FRU)	
CP Test Date	
None	
Unknown	

Tank Internal Protection

Fiberglass	
Interior Lining	
None	X
Unknown	

Date Tank Lined:

Leak Detection System for Tanks

Vapor Monitoring Wells	
Groundwater Monitoring Wells	
Double-walled Tank with Interstitial Monitoring	
Interstitial Monitoring with a Secondary Barrier	
Interstitial Monitoring w/ Secondary Containment	
Automatic Tank Gauging	
Tank Tightness Testing w/Daily Product Inventory	
Statistical Inventory Reconciliation	
Manual Tank Gauging	
None	

Piping Construction and Protection

Bare Steel	
Double Wall Steel	
Galvanized Steel	
Fiberglass Reinforced Plastic (FRP)	
Double Wall (FRP)	
Double Wall	
Flexible Wall	X
Cathodically Protected	
Unknown	

Specify External Coating:

Piping Leak Detection

Automatic Line Leak Detectors (Mechanical)	
Automatic Line Leak Detectors (Electronic)	X
Line Tightness Testing	
Statistical Inventory Reconciliation	
Interstitial Monitoring	
Secondary Barrier	
Secondary Containment	
Vapor Monitoring	
Groundwater Monitoring	
Safer Suction	
Suction	
None	

Spill and Overfill

Spill Protection	X
Catchment Basin	
Size: 15	
None	X
Overfill Prevention	
Automatic Shut-Off Device @ 95% full	X
Flow Restrictor at 90% full (e.g., ball float)	
High Level Alarm at 90% full	

INTERNAL & EXTERNAL PROTECTION/LEAK DETECTION SYSTEM

Tank Number: 27

Tank External Protection

Cathodic Protection	
Field Installed Cathodic Protection	
Factory Installed Cathodic Protection	
Impressed Current Cathodic Protection	
Painted or Asphaltic Coated	
Fiberglass Reinforced Plastic Coated (FRP)	X
Factory Applied Coal Tar Epoxy Coated	
Fiberglass Reinforced Urethane Coated (FRU)	
CP Test Date	
None	
Unknown	

Tank Internal Protection

Fiberglass	
Interior Lining	
None	X
Unknown	

Date Tank Lined:

Leak Detection System for Tanks

Vapor Monitoring Wells	
Groundwater Monitoring Wells	
Double-walled Tank with Interstitial Monitoring	
Interstitial Monitoring with a Secondary Barrier	
Interstitial Monitoring w/ Secondary Containment	
Automatic Tank Gauging	
Tank Tightness Testing w/Daily Product Inventory	
Statistical Inventory Reconciliation	
Manual Tank Gauging	
None	

Piping Construction and Protection

Bare Steel	
Double Wall Steel	
Galvanized Steel	
Fiberglass Reinforced Plastic (FRP)	
Double Wall (FRP)	
Double Wall	
Flexible Wall	X
Cathodically Protected	
Unknown	

Specify External Coating:

Piping Leak Detection

Automatic Line Leak Detectors (Mechanical)	
Automatic Line Leak Detectors (Electronic)	X
Line Tightness Testing	
Statistical Inventory Reconciliation	
Interstitial Monitoring	
Secondary Barrier	
Secondary Containment	
Vapor Monitoring	
Groundwater Monitoring	
Safer Suction	
Suction	
None	

Spill and Overfill

Spill Protection	X
Catchment Basin	
Size: 15	
None	X
Overfill Prevention	
Automatic Shut-Off Device @ 95% full	X
Flow Restrictor at 90% full (e.g., ball float)	
High Level Alarm at 90% full	

INTERNAL & EXTERNAL PROTECTION/LEAK DETECTION SYSTEM

Tank Number: 28

Tank External Protection

Cathodic Protection	
Field Installed Cathodic Protection	
Factory Installed Cathodic Protection	
Impressed Current Cathodic Protection	
Painted or Asphaltic Coated	
Fiberglass Reinforced Plastic Coated (FRP)	X
Factory Applied Coal Tar Epoxy Coated	
Fiberglass Reinforced Urethane Coated (FRU)	
CP Test Date	
None	
Unknown	

Tank Internal Protection

Fiberglass	
Interior Lining	
None	X
Unknown	

Date Tank Lined:

Leak Detection System for Tanks

Vapor Monitoring Wells	
Groundwater Monitoring Wells	
Double-walled Tank with Interstitial Monitoring	
Interstitial Monitoring with a Secondary Barrier	
Interstitial Monitoring w/ Secondary Containment	
Automatic Tank Gauging	X
Tank Tightness Testing w/Daily Product Inventory	
Statistical Inventory Reconciliation	
Manual Tank Gauging	
None	

Piping Construction and Protection

Bare Steel	
Double Wall Steel	
Galvanized Steel	
Fiberglass Reinforced Plastic (FRP)	
Double Wall (FRP)	
Double Wall	
Flexible Wall	X
Cathodically Protected	
Unknown	

Specify External Coating:

Piping Leak Detection

Automatic Line Leak Detectors (Mechanical)	
Automatic Line Leak Detectors (Electronic)	X
Line Tightness Testing	
Statistical Inventory Reconciliation	
Interstitial Monitoring	
Secondary Barrier	
Secondary Containment	
Vapor Monitoring	
Groundwater Monitoring	
Safer Suction	
Suction	
None	

Spill and Overfill

Spill Protection: X

Catchment Basin

Size: 15

None: X

Overfill Prevention:

Automatic Shut-Off Device @ 95% full	X
Flow Restrictor at 90% full (e.g., ball float)	
High Level Alarm at 90% full	

The following pages contain the inspection compliance checklist to use when conducting the inspection. The checklist is intended to serve as a guide to cover all the compliance items during the inspection and the information needed to enter in the UST Inspection web application.

Compliance Inspection Report

Section 1. General Information

Facility Name	
Registration No.	
Facility Address	
City/Zip	
Cardtrol Facility	
Always staffed while in operation	
Insurance	
Method	
Insurer	
Policy No.	
Start Date	/ /
Expiration Date	/ /
Affiliate Detail	
Operator Name	
Facility Phone	
Fax	
E-mail	
Owner Name	
Owner Address	
City/State/Zip	
Site Owner Name	
Site Owner Address	
City/State/Zip	
Phone	
E-mail	
LUST Detail	
LUST ID (only if active)	
Inspection Detail	
Date of this Inspection	/ /
Inspection Type	
Date of Previous Inspection	/ /
Inspector/Inspector Cert. No.	

Section 1 above includes general information about the site you are inspecting. When the UST registration number or site name is entered into the UST Inspection database, these fields will be populated. The only information you should have to fill in on this page is the Inspection Detail. All the

other information should be provided unless changes have occurred. Double check with the owner to make sure the information is correct.

Section 2. Tank and Piping Information

Upload photos of the facility and inspection, or include a basic layout of the UST System.

Key/Legend (include as applicable)	
T	**Tanks, including compartments and tank numbers**
F	**Fill Port**
ATG	**Tank Probe and Consoles**
PS	**Piping or Transitional Sumps**
D	**Dispensers**
A	**Alarms**
P	**Product Piping**
↑	**North arrow**

Section 2 allows photos of the site to be uploaded. A site sketch is not essential, especially if it already exists from a previous inspection.

Section 3. Temporary Closure [567--IAC 135.15(1)]

Fill out this section only if a tank is temporarily closed or taken out of service. Check the tank(s) to ensure tank fill ports are locked and that they comply with temporary closure requirements. If database indicates tanks are temporarily closed, it means the owner/operator sent in necessary paperwork.

Answer all with Yes or No	Tank #	Tank #	Tank #	Tank #
Tank Contains less than 1" of product				
Tank vented and fill pipe locked				
Date temp. closed or taken out of service (Month/Day/Year)	/ /	/ /	/ /	/ /
Cathodic protection maintained (if applicable)				
Financial Responsibility maintained				

Temporarily Closed Tanks. Tanks are temporarily closed when the owner/operator stops using it and empties it. If more than one (1) inch of regulated product remains in the tank, it is considered an active tank. Leak detection is not required for empty tanks. Steel tanks must maintain cathodic protection. An inspector must perform a complete inspection for temporarily closed tanks including as applicable, insurance, corrosion protection, spill and overfill, etc.

Section 4. Tank and Piping Information

Tanks	Tank #	Tank #	Tank #	Tank #
Status (Active or Temp closed)				
Brand/Model				
Installation Date	/ /	/ /	/ /	/ /
Construction Material				
Capacity (Gallons)				
Compartments				
Double-Wall				
Emergency Power Generator				
Tag Attached to Fill Port				
Product (Specify type)				

Piping	Tank #	Tank #	Tank #	Tank #
Piping Brand/Model				
Construction Material				
Pressure/S Suction/Suction				
Double-Wall				

The information in Section 4 should also be populated. If some of the information is not available on the database, obtain it while you are on site conducting the inspection. Initially the permanent tank ID number must be entered.

Compartment Tanks are considered separate tanks. Identify compartment tanks by using the permanent tank ID number on the purple tag.

Emergency Power Generator Tanks [135.1(3)"d"] are exempt from leak detection requirements only. Dual purpose tanks (i.e., used for heating and emergency power) are considered emergency power generator tanks and therefore are regulated tanks, except for leak detection requirements.

Unregistered Tanks [135.3(3)"c"]. If an unregistered UST subject to UST regulations is discovered during the inspection, it must be inspected with the other tanks. Indicate on the form any unregistered, regulated tanks. Make sure the owner files an amended UST registration from as soon as possible. Owners/operators are required to complete and submit to the department a copy of the registration form within 30 days of installing the tank in the ground. A regulated substance may not be deposited into a tank without the prior approval of the department. This means that if a tank is newly installed and needs product for tightness testing, the DNR must provide authorization.

Shaded Questions/Items of this checklist are considered to be of significant operational compliance and must pass inspection. A question that is not in a shaded box does not necessarily have to pass, but certain restrictions may apply.

Verification of Compliance. A large part of the checklist is based on answering questions choosing the appropriate item from a drop-down box. Most questions on the checklist are answered by

checking “Yes” or “No.” Answer a question with “Yes” only if it is in compliance at the time of the inspection with no adjustment or correction. If anything is done to repair, fix, replace a piece of equipment or correct an operating procedure, then answer the question with a “No.” Describe the “No” answer in the area at the bottom of the page under Deficiencies and Corrections.

Deficiencies. At the bottom of each section there is a place to enter any compliance problems encountered during the inspection. Even if the problem is fixed before completion of the inspection (e.g., a spill bucket filled with debris or liquid), note the deficiency. Some deficiencies may fail an inspection. A failed inspection is when any of the items in the Compliance Verification Section of the last page is answered “No.”

Corrections. At the bottom of each section there is a place to note any corrections made during the inspection. This section should be only used when a correction is made during the inspection. Corrections are not recommendations, they are problems or deficiencies that have been fixed and completed during an inspection (e.g., a dispenser leak). Problems or deficiencies that have been fixed after the inspection is conducted and after the inspection form is submitted to DNR should be noted in Section 12.

Further Recommendations. At the bottom of each section there is a place to note any suggested recommendations based on the results of the inspection. Recommendations are suggestions to increase the overall performance of certain UST equipment.

Digital Photos: Digital photos of deficiencies, including sumps, spill buckets, sensors, probes, ALLDs, voltage readings of rectifiers, sub pumps, leak detectors and other items capable of documenting with a photo, are required. The preferred file format is .JPG for sending via e-mail. If you don’t have high-speed internet or e-mail access, send the photos on disc. See EPA-F-06-002 document on digital camera use and guidance for documenting inspections.

Improvements: Let the DNR know if there are problems regarding the inspection that you cannot resolve, or any way DNR could help you make the inspection better for you and the owner/operator.

Section 5. Leak Detection Summary

Tanks	Tank #	Tank #	Tank #	Tank #	Go To
Automatic Tank Gauging	☐	☐	☐	☐	**6.a.**
Interstitial Monitoring/Sec. Cont.	☐	☐	☐	☐	**6.b.**
SIR	☐	☐	☐	☐	**6.e.**
Manual Tank Gauging (<1001 g)	☐	☐	☐	☐	**6.f.**
Manual Tank Gauging (<2001 g)	☐	☐	☐	☐	**6.f.**
Groundwater Monitoring	☐	☐	☐	☐	**6.g.**
Vapor Monitoring	☐	☐	☐	☐	**6.h.**
Inventory Control/TTT	☐	☐	☐	☐	**6.c. & 6.d.**
Secondary Barrier	☐	☐	☐	☐	**6.b.**

Section 5. Leak Detection Summary (continued)

Piping	Tank #	Tank #	Tank #	Tank #	Go To
Mechanical LLD (3 gph)	☐	☐	☐	☐	**6.i.**
Electronic LLD (0.2 or 0.1 gph)	☐	☐	☐	☐	**6.i.**
Annual Tightness Test	☐	☐	☐	☐	**6.d.**
Interstitial Monitoring/Sec. Cont.	☐	☐	☐	☐	**6.b.**
SIR	☐	☐	☐	☐	**6.e.**
Suction	☐	☐	☐	☐	**6.d.**
Safer Suction	☐	☐	☐	☐	**6.j.**
Groundwater Monitoring	☐	☐	☐	☐	**6.g.**
Vapor Monitoring	☐	☐	☐	☐	
Secondary Barrier	☐	☐	☐	☐	**6.b.**

This section provides an overview of the leak detection monitoring or method (RDM) used at the facility. If this page is already completed, make sure the information is correct and then proceed to the right-hand column to further determine if the specific RDM is conducted properly. The UST Inspection database will display the appropriate screens depending on the entries.

Maintaining Records. Owners/operators are to keep the last 12 months of leak detection records on site or readily available [135.5(6)] when requested. You should have no problem accessing records. The owner will contact you to schedule an inspection at which time you can tell the owner/operator what records to have available (you may request and review records prior to the on-site inspection). Specify that you want RDM records, such as ATG system printouts or logs, available and organized (you don't want to have to sift through months of ATG system printouts in a shoebox). If they do not have them available at the time of inspection, give them a deadline (usually two working days) to get the records to you. Tanks must be monitored at least every thirty days for releases, and every week for manual tank gauging. An inspection is not complete until the records are reviewed.

Twelve Months of Records. If an owner is missing some of the past 12 months of RDM records, this does not mean the tank system fails inspection. The tank system would fail inspection only if the owner/operator could not prove that release detection was working at the time of the inspection. Passing the most recent 30 days worth of relapse detection requirements enables the inspection to pass with an incomplete for RDM records.

Common Problems and Errors: Automatic Tank Gauging

- Not running a test at least once a month
- Not running a valid test (fail to test at the level it is routinely filled) at least once a month or not meeting the minimum product level for third party evaluation or test time is too short
- Not responding to alarms
- Not having an ATG that is serviceable
- Not following maintenance and calibration schedules
- Not third party evaluated for large or manifolded tanks
- No documentation available
- Probe not functioning, not connected
- Probe incompatible with console
- Probe incompatible with product

- Out of paper, paper jammed or ink illegible
- Power or warning lights burned out
- No log of results for the last 12 months
- Having two consecutive months of invalid leak detection results and not reporting it as a suspected release to DNR

Results of "Fail." If you note a failed test result when reviewing the 12 months of RDM records, it should be noted in the Deficiencies part of the inspection compliance checklist unless the owner/operator had already reported and resolved the incident. A result of "Fail" must be reported unless it can be readily explained (product theft, aborted test, etc.). If a release is suspected, the inspector must notify the owner/operator to contact the DNR.

Pressurized Piping Requirements. Pressurized piping systems require two methods of release detection. An owner/operator must have a method for detecting large catastrophic leaks and one for detecting small leaks. All pressurized piping should have a line leak detector, which restricts or shuts off product flow. Proposed rules will require an automatic line leak detector on all pressurized lines.

Possible Leak Detection Combinations for Piping
Automatic Line Leak Detector (3 gph) and double-wall pipe with liquid sump sensor
Automatic Line Leak Detector (3 gph) and annual line tightness test
Automatic Line Leak Detector (3 gph) and SIR monthly
Automatic Line Leak Detector (3 gph) and double-wall pipe with manual interstitial monitoring
Automatic Line Leak Detector (electronic) that can perform 3 gph continuous, plus 0.2 gph/month and/or 0.1 gph annual

When interstitial monitoring is used on pipe, an annual line tightness test is not required. The pressurized pipe must have an automatic line leak detector.

Section 6.a. Automatic Tank Gauging (Tank Only) [567--IAC 135.5(4)d]

#	Tank Only	Tank #	Tank #	Tank #	Tank #
1	**Console Make and Model**				
2	**Mag, Ultrasonic or Cap. Probe**				
3	**CSLD**				
4	**Tank is tested near level it is routinely filled**				
5	**Last 12 months of LD monitoring records available and acceptable**				
6	**Monitoring panel or control box is present and operational. All probes functioning.**				
7	**ATG is operating accordingly to certification, test period and limitations of third party evaluation**				
8	**ATG test results meet tank capacity requirements of third party eval. (minimum/maximum product levels, test time)**				
9	**Existing release detection results show no evidence of a release.**				
ATG passes inspection. Questions 4-9 are all acceptable					

Here begins the compliance part of the checklist. Shaded areas are required for compliance. If the answer to any shaded area is "No", the ATG fails. The same is true for the other release detection methods.

Lines 1-2: List make and model of ATG system in use and specify the type of probes in use.

Line 3: Does the ATG system provide Continuous Statistical Leak Detection (CSLD) or the equivalent?

Line 4: Is the ATG conducting valid tests (i.e., are the tanks tested at the product level they are routinely filled)? Look at the product level/ullage at the time of the "Pass" and determine if the product level is acceptable.

Line 5: If a month or more of records are missing, you should be able to print it out or have someone authorized by the owner/operator to print it for you. Again, these records should be available already. Tell the owner/operator to retain ATG system printouts/tests. Only one "Pass" is required each month. Just make sure it is understood that the printout saved must be when the product volume of the tank is at its highest, and also meets minimum testing levels of the third-party evaluation and manufacturer's requirements.

If it appears testing and record keeping is sporadic (missing four or more months of records, but has most recent months), require the owner/operator to submit the next four months of printouts to the DNR as proof they are conducting monthly monitoring. If it doesn't look as though the owner/operator is conducting leak detection, require a static test of the system.

Line 6: Make sure the probes are present and the ATG is in good working order (i.e., the LED reads "All functions normal" and the power light is on).

Lines 7-8: Some of the problems you may run into are 1) Sites that operate 24 hours a day but are not programmed to run a continuous test. ATG systems need some quiet time where no fuel is added or dispensed in order to run a valid test. Options are to install CSLD or the equivalent, conduct a static test or run the ATG system for information only and submit the information to a SIR vendor. 2) Make sure the tank size does not exceed the ATG system's capability and evaluation, especially tanks of 15,000 gallons or greater capacity. Consult your copy of *List of Leak Detection Evaluations for UST Systems*.

Line 9: Based on the results of the records you reviewed, indicate whether there is evidence of a release or suspected release from each tank.

ATG Passes Inspection: If answers to shaded questions are "Yes," the ATG system passes inspection. If any one answer to the shaded questions is "No," the ATG system fails inspection. Explain the "Fail" in the Deficiencies section.

Deficiencies, Corrections and Further Recommendations. If any answer to the shaded questions is "No," explain it in this section. Any problems encountered during the inspection should be noted here, including those that were corrected, fixed, repaired or replaced. In addition, any recommendation you think appropriate for improved operation and maintenance should be made here.

Notes: ATG systems provide both inventory and testing information. Each tank is equipped with a probe that fits into the tank through a riser. Each probe is wired to a computer console and monitor installed inside the building. ATG systems are popular because they require minimal operator involvement and provide continuous product information from inventory to tank and line leak alarms.

The tank tightness testing is usually programmed to begin early in the morning when stations are either closed or traffic is reduced. Product level must be constant for the test (i.e., the pump cannot be activated during the testing period) or the test will abort. The length of the test varies with the system and the level of testing desired. Newer ATG systems are capable of testing at 0.2 gph, and 0.1 gph. Tests generally range from one to six hours in length with most tests taking around two to four hours to complete. Product level and temperature is taken frequently and averaged during test time. The ATG system is looking for changes in volume or product level during the static test time and takes into account deflection of the tank and temperature of the product (both of which affect volume). Many high-volume stations have gone to CSLD, which takes inventory when there is no dispensing activity. The system uses statistical analysis of the inventory data to determine if the tank is tight.

When the inventory mode of the ATG system is operating (which is whenever the system is not testing), it also takes temperature and volume measurements. The owner/operator uses these measurements to know when to order product. Most ATG systems have low-level alarms that alert the owner/operator. ATG systems also record the amount of product dispensed and delivered.

Increases in tank volume above the minimum rate are read as deliveries. Inventory data is then automatically reconciled at intervals set by the owner/operator or the ATG service rep.

ATG system probes also measure the water in the tank. Be sure to look at the water level when reviewing the test report from an ATG system (see the photo section on ATG panels). Always verify current system status when looking at an ATG panel; and unless you are intimately familiar with ATG systems, always take the ATG System Monitoring & Line Leak Detection Manual along on your inspections.

ATG systems are capable of testing only the portion of the tank that contains product. Therefore, if a tank is routinely filled to 80 percent of its capacity, it should be tested near that level at least once per month. It is the owner's/operator's responsibility to test all portions of the tank routinely in contact with product. It defeats the purpose of leak detection to run the tests only on partially filled tanks. It is also easier to detect a release in a tank that is 80 percent full than a tank that is 50 percent full because of the greater head pressure. An ATG system cannot be as accurate finding a 0.2-gallon-per-hour leak in the tank when it is 50 percent full compared to 80 percent full.

As mentioned earlier, always take with you a list of Leak Detection Evaluations for UST Systems (List) to ensure leak monitoring equipment such as ATGs are operated within the criteria in the List.

The list is published by the EPA and is based on reviews of **the National Work Group on Leak Detection Evaluations (NWGLDE).** NWGLDE (**http://www.nwglde.org**) is comprised of state and EPA staff. The List contains information on tank and piping leak detection system evaluations that have met certain criteria. To be included, an evaluation must have been performed by an independent third party in accordance with EPA protocols, and with leak rates blind to the evaluator.

All leak detection methods must be evaluated and should be included in the List. Make certain the LLD, ATG system, SIR method or sensor you encounter during an inspection is on the List and is being operated according to the criteria in the List.

An ATG system may show a tank leak test result as passing; however, look carefully at the tank leak test report to make sure the volume of product in the tank is at or above the minimum test level of the evaluation. Frequently inspectors will find tank leak test reports that show the volume in the tank well below 50 percent of the tank's capacity. This may be an invalid test. Make sure the owner/operator at least tests the tanks at or above the level the ATG system was evaluated and near the maximum monthly fuel level. If the owner/operator does not fill the tank to the minimum level at which the ATG system was evaluated, he/she may have to incorporate another leak detection method into the site's RDM program.

Section 6.b.1 Interstitial Monitoring (Manual) [567--IAC 135.5(4)g]

#	Answer all that apply with a Yes or No for each tank and pipe	Tank #	Pipe #	Tank #	Pipe #	Tank #	Pipe #	Tank #	Pipe #
Manual System									
1	Equipment (calibrated stick, vapor meter, etc.) is accessible and functional.								
2	Interstitial space is lowest point of secondary containment and positioned so that other equipment will not interfere with its proper operation.								
Summary									
3	Monthly release detection records are available for last 12 months.								
4	No evidence of liquid in sump or interstitial space.								
5	Existing release detection results show no evidence of a release.								
Interstitial Monitoring passes inspection. Questions 1, 2, and 3-7 are acceptable for Manual.									

Section 6.b.2 Interstitial Monitoring (Electronic) [567--IAC 135.5(4)g]

#	Answer all that apply with a Yes or No for each tank and pipe	Tank #	Pipe #	Tank #	Pipe #	Tank #	Pipe #	Tank #	Pipe #
Electronic System									
1	**Interstitial sensor type (discriminating (D), non-discriminating (ND)**								
2	**Monitoring console operational**								
3	**Interstitial sensor visually inspected, functionally tested, and confirmed operational**								
4	**Interstitial sensor installed in lowest point of secondary containment and positioned so that other equipment will not interfere with its proper operation.**								
Summary									
5	**Monthly release detection records are available for last 12 months.**								
6	**No evidence of liquid in sump or interstitial space.**								
7	**Existing release detection results show no evidence of a release.**								
Interstitial Monitoring passes inspection. Questions 1, 2, 3, 4 and 5-7 are acceptable for Electronic.									

Effective August 1, 2007, all new and replacement UST systems must be constructed to provide secondary containment if they are within 1,000 feet of any public water supply or potable drinking water well. Secondary containment rules can be found in Chapter 135 of the UST regulations.

Secondary containment includes double-wall tanks and piping turbine sumps, transition or intermediate sumps, and under dispenser containment (UDC).

New or replacement secondary containment systems must be visually inspected to ensure they are free of debris, liquid and ice, that all penetration seals into the sumps are tight and in good condition, that electronic sensing devices are positioned properly and functional, metal flex connectors are in good condition and not twisted, kinked or degraded and that piping, turbines and other equipment are in good condition. Make sure sumps and catchment basins are in good condition and liquid tight.

RDM for interstitial monitoring may be used for piping with secondary containment designed and capable of interstitial monitoring. RDM for secondary containment may consist of 1) continuous leak

detection such as an automatic sensing device in the interstitial space (that signals the operator of the presence of a leak or 2) a visual or manual checking of the interstitial space (e.g., with meter, stick or visual inspection).

If the site is using interstitial monitoring or secondary containment as a RDM, complete this section. Interstitial monitoring or secondary containment is the most straightforward, accurate method of conducting RDM. This method monitors the space between the primary and secondary barrier of a double-walled UST or a lined excavation [135.5(4)"g"]. Monitoring devices may be as simple as a dipstick or vacuum gauge or as sophisticated as an automated system that continuously checks for leaks and feeds results to a console of the ATG. The monitor must be checked at least once every 30 days, and results recorded.

MANUAL

Line 1: The inspector must be able to access and read the equipment that measures the interstitial space. It may be 1) A dipstick or measuring device, 2) Water/fuel indicator paste and a log of monthly readings maintained by the owner/operator. The log would show the presence or absence of liquid. The inspector should perform a manual test of the interstice to ensure the accuracy of the log readings.

Line 2: Adequate interstitial monitoring is only achieved if it takes place at the lowest point in the system. Evaluate the system to ensure interstitial monitoring is positioned at the lowest point.

ELECTRONIC

Lines 1-3: For electronic readouts of interstitial monitoring, describe whether the sensor is liquid or discriminating. List tank and piping separately. Make sure the console or monitoring box is operational. Use the "test" or "diagnostic" mode to confirm. Make sure the sensors are placed at the recommended height off the floor of the sump or interstice. Note deficiencies. You may test the sensor's functionality by following the manufacturer's literature. Normally in pipe sumps, this means turning the sensor upside down or immersing it in liquid, but make sure you check with the literature.

SUMMARY (MANUAL AND ELECTRONIC) The owner/operator should have records for the past 12 months. Interstitial monitoring is a comparatively easy method to monitor. Make sure recent month's results are "Pass." Based on your visual inspection of the interstice or information from readings from electronic sensors, verify there is no product or water in the interstice.

Interstitial Monitoring Passes Inspection. Based on an answer of "Yes" to the shaded questions, the interstitial monitoring system passes inspection. If any of the answers to the questions is "No," the system does not pass inspection.

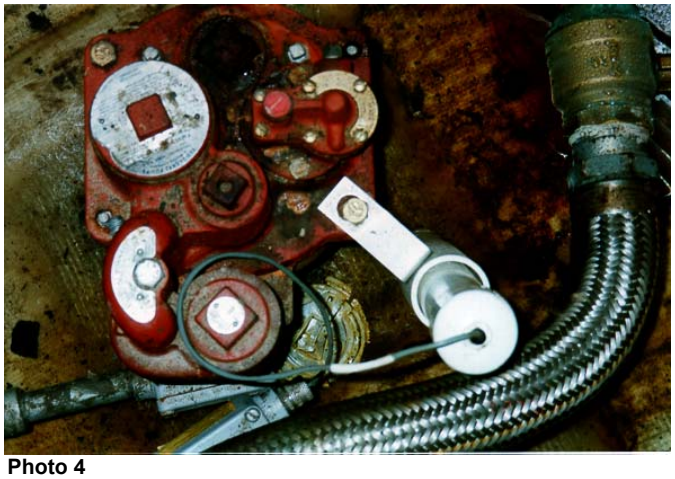


Photo 4

Photo 5

In both of these photos, the sensor has been elevated above the submersible turbine. In Photo 5, the sump would appear to be in poor condition, which might explain the placement of the sensor. While there is no regulation that specifies the exact height of a sump sensor off the floor of a sump, these are clearly set too high. A sensor placed too high will not detect liquid in the sump until it is too late. A sensor set too low will activate whenever ingress of water occurs. If you have a question about sensor height, consult the manufacturer's literature, but common sense dictates a height just off the bottom of the sump, not too low and not too high, will effectively detect a release.

Common Problems and Errors: Interstitial Monitoring

- Not keeping a written log of the monthly inspections
- Not keeping a printed copy of monthly leak detection records (electronic)
- Sensor not present (electronic)
- Sensor not functioning (electronic)
- Sensor placed too high in the sump to be effective
- Sensor submerged in product or water
- Sensor removed from tank interstice
- Water in interstice
- No maintenance or calibration of sensors
- Interstitial riser tube not tight or connected to tank top
- Sensor only form of leak detection for pressurized piping
- Sensor not positioned in lower-most portion of piping run, or
- Not testing or measuring every 30 days

Section 6.c. Inventory Control (Tank Only) [567--IAC 135.5(4)a]

Fill out this section if tank uses Inventory Control and/or SIR.

#	Answer Yes or No for each tank	Tank #	Tank #	Tank #	Tank #
1	Gauge stick is marked so the owner is capable of determining product level to the nearest 1/8" or in accordance with the SIR method				
2	Fuel deliveries are measured and recorded				
3	Monthly water readings checked to the nearest 1/8" and used in calculating inventory balances				
4	Fill pipe drop tube observed				
5	Amount Pumped is Recorded (totalizer at dispenser)				
6	For the last 12 months each monthly overage or shortage is less than 130 gallons + 1% of tank's monthly flow through (sales) volume				
7	Last 12 months of inventory data available.				
8	Existing release detection results show no evidence of a release.				
9	Method no longer can be used.				
Inventory Control Passes inspection. Questions 1 through 6 are all acceptable.					
If using Statistical Inventory Reconciliation (SIR), also fill Section 6.e If using Inventory Control only, also fill out Tightness Testing section 6.d					

Lines 1-2: Is the owner/operator taking good daily readings, including liquid levels, sales and delivery? Is the fuel gauge stick tall enough to measure the full height of the tank and calibrated to the nearest 1/8th-inch for accurate measurement? Is a calibration chart available to convert stick readings into gallons? Review all the data and make sure inventory control is done properly. If the owner/operator is not using a formal log, refer them to the EPA booklet *Doing Inventory Control Right* in the back of this manual for an Inventory Control Form.

Line 3: The tank must be checked for the presence of water at least once a month. If water is present, it must be measured to the nearest 1/8th of an inch. That information has to be used in calculating inventory balances. If not, the owner/operator must begin doing so immediately.

Line 4: Without a drop tube, inventory control fails. A drop tube helps stabilize the fuel for an accurate product level measurement.

Line 5: Each UST system using inventory control must have a totalizer that is accurately calibrated in order for this method of release detection to work.

Line 6: Inventory Control is not an exact method of leak detection. Regulations allow for overages or shortages each month, not to exceed 130 gallons plus 1% of the tank's monthly throughput. Check the math on the inventory control form for the last complete month of results and confirm this amount has not been exceeded.

Lines 7-8: If records appear to be in order, there is no evidence of a release and the shaded questions are answered with a "Yes," then the inspection passes. If an answer to any of the

questions is “No,” the inventory control system fails inspection. Explain any “No” in the deficiencies section.

Line 9: The ten-year anniversary date from when the tank was upgraded or installed (new tank) has passed. Inventory control can no longer be used as sole method of leak detection.

Notes: Inventory control (with tank tightness testing) is a temporary method that can be used for 10 years after tank installation. Inventory control and tank tightness testing were also allowed on old tanks prior to 12/22/98; but again was a temporary leak detection method and terminated 10 years after the tank was upgraded with corrosion protection (lining or cathodic protection). If you come across a tank system using this method, make sure it was installed within the last 10 years; otherwise, it is a violation and the owner/operator must switch to a stand-alone method As an RDM, inventory control can never be used alone. Tanks must be tightness tested every 5 years. Inventory control does not meet piping RDM requirements.

Inventory control must be capable of detecting a release of 1.0 percent of throughput plus 130 gallons. Inputs and withdrawals and the amount remaining in the UST must be recorded each day. The measuring stick must be calibrated to 1/8th-inch. The owner/operator must also measure any water on the bottom of the UST to the nearest 1/8th-inch at least once a month and record it. See the EPA booklet, *Doing Inventory Control Right*, for proper inventory control record keeping. Many owners and operators will conduct inventory control as a secondary method of leak detection.

Inventory control is not the best, most-accurate method of leak detection, but it is the least expensive. Any time one measures the volume of product in the tank, the volume of product sold, the volume of product delivered and then reconciles it monthly, there are bound to be errors in the calculations. Overall, however, inventory control can reveal problems if one is conscientious about recording the daily information.

Common Problems and Errors: Inventory Control

- Doing reconciliation math wrong
- Not gauging the tank every operating day
- Not gauging the tank through a drop tube and not using a tank gauge stick calibrated to 1/8 of an inch increments
- Gauge stick worn down at bottom or too short to measure full height of tank
- Not checking for water once per month and recording it
- Not recording all deliveries
- Not reconciling at the end of the month (this is what tells you if you have a leak) or doing calculations wrong
- Not testing the dry portion of the tank (ullage test) while conducting the required tank tightness test
- Not conducting periodic tightness testing
- Not reconciling deliveries with fuel receipts
- Not having calibrated dispenser (totalizer)
- Method can no longer be used

Section 6.d. Tightness Testing (Tanks and Piping) [567--IAC 135.5(4)c]

Fill out this section if tank and/or or pipe used periodic tightness testing

#	Answer Yes or No for each tank and pipe	Tank #	Pipe #	Tank #	Pipe #	Tank #	Pipe #	Tank #	Pipe #
1	**Test method approved by third party evaluation.**								
2	**Last tightness test results completed within required frequency. Results are available and pass.**								
3	**Still eligible for combination of Inventory Control and TTT. (Expiration date is: / /).**		***NA***		***NA***		***NA***		***NA***
Tightness Testing passes inspection. Questions 1 through 5 are all acceptable.									

Line 1: Make certain the tightness test for the tank or piping is third party evaluated. The department requires a third party evaluator or tester to conduct the annual line tightness test or 10- or 5-year tank tightness test.

Lines 2 and 3: As long as the owner/operator is still eligible for the combination method and/or results of the tightness test are "Pass," the tightness test passes inspection. If the answer to any shaded question is "No," explain it in the deficiency section.

Common Problems and Errors: Tightness Testing

- Using a volumetric test and not having the product level in the tank at the level which routinely contains product when the test is performed
- Not using a tightness test method approved or evaluated by a third party
- Not conducting annual line tightness testing
- Not conducting periodic tank tightness testing

Section 6.e. Statistical Inventory Reconciliation (Tank and Piping) [567--IAC 135.5(4)]

Fill out this section if tank and/or pipe use Statistical Inventory Reconciliation (SIR) for monthly release detection monitoring. Fill out either ATG or Inventory Control sections depending on which method is used for data collection.

	Answer Yes or No for each tank	Tank #	Pipe #	Tank #	Pipe #	Tank #	Pipe #	Tank #	Pipe #
1	SIR method third party evaluated								
2	SIR Vendor Name								
3	No consecutive *inconclusive* results in the last 12 months prior to inspection								
4	SIR results returned within two weeks of the end of each month?								
5	No test *Fail* in last 12 months.								
6	Existing release detection results show no evidence of a release.								
7	Not receiving SIR results within two weeks of data collection.								
	SIR Passes Inspection Questions 1 and 3 through 6 are acceptable.								

Lines 1: As with other leak detection methods, ensure the SIR version in use is third party evaluated. Check the List of Leak Detection Evaluations for the vendor.

Line 2: Include the vendor's name/method/version.

Line 3: Make sure there are no consecutive "Inconclusive" or "Fail" results.

Line 4: SIR results must be returned in a timely manner (two weeks after data are submitted). If the answers to the shaded questions are "Yes," SIR passes inspection. An answer of "No" to any of the shaded questions would result in a failed SIR inspection.

Notes: There are three possible bottom-line responses for any SIR test results: **Pass, Fail or Inconclusive.** When you review the SIR reports, look at the calculated leak rate, the minimum detectable leak rate and the leak threshold to make sure they equate with the result of Pass. In the past, we have found tanks that have been declared passing by the vendor when, in fact, the calculated leak rate exceeded the threshold. The *leak threshold* is a value set by the leak detection system manufacturer in order to meet the probability of detection (95%) and probability of false alarm (5%). Sometimes the threshold is raised in order to reduce the instances of false alarms. Compare the calculated leak rate with the threshold. If the calculated leak rate exceeds the reportable loss threshold, a "Fail" should be declared and further investigation required.

As with ATG systems, if you observe a "Fail" on SIR reports, determine if it is a false alarm or if it indicates a loss of product or influx of groundwater. "Inconclusive" usually means the data provided to the SIR vendor are poor quality or inadequate, and the vendor is not able to make a determination. "Inconclusive" means the owner operator has failed to perform leak detection on the UST in question for that month. If it is not reconciled within the month, it is a violation. Two consecutive "Inconclusive" indicates a "Fail" and must be reported.

SIR must be capable of detecting at least a 0.2-gallon-per-hour leak rate to be used as an acceptable RDM. SIR vendors may also be capable of testing at a 0.1-gallon-per-hour leak rate. SIR analyzes inventory, delivery, and dispensing data collected over a period of time to determine whether a tank system is leaking. Data is collected each day of operation, either by gauging stick or ATG system and submitted monthly to the SIR vendor. Look for a two-week turnaround on SIR reports.

Annual line tightness testing, according to 135.(5) requires a 0.1 gph leak rate at one and one-half times the operating pressure. SIR's capability does not include applying one and one-half times the operating pressure to a product line; therefore, it may not be used for annual line tightness testing.

Common Problems and Errors: Statistical Inventory Reconciliation (SIR)

- Having two consecutive months of *inconclusive* results and not reporting it to DNR
- Not using a third-party-approved vendor
- Not collecting data according to vendor's instructions
- Not following SIR vendor's recommendations to improve daily readings
- Not receiving results within two weeks of data collection

Section 6.f. Manual Tank Gauging [567--IAC 135.5(4)b]

#	Answer Yes or No for each tank	Tank #	Tank #	Tank #	Tank #
1	**Tank is between 1001 and 2000 gallons and has not exceeded expiration date of MLD as sole method**				
2	**Measuring stick is calibrated to 1/8th inch.**				
3	**Manual Tank Gauging Records available for past 12 months.**				
4	**Manual Tank Gauging conducted properly each week using the correct standards and duration.**				
5	**Calculated volume change does not exceed monthly or weekly standards.**				
6	**Existing release detection results show no evidence of a release**				
7	**Method can no longer be used.**				
Manual Tank Gauging passes inspection. Items 1 through 6 are all acceptable.					

Line 1: If the owner is using manual tank gauging (MTG) on a tank greater than 1,000 gallons, make sure the tank is still eligible to be using MTG. Refer to the chart above to make sure the owner/operator is taking measurements at the correct time interval, depending on the size and diameter of the tank. Refer to the table below to make sure the owner/operator is taking measurements at the correct time interval, depending on the size and diameter of the tank.

Line 2: The gauging stick should be calibrated to the nearest 1/8th-inch, and should measure the full height of the tank for accurate measurements. If not, the stick is inadequate and should be replaced.

Line 3: Make sure the manual tank gauging data has been reconciled to determine if a leak occurred. Make sure the last complete month of data is properly reconciled, even if there is a passed tightness test.

Line 4: Use the table below to make sure the owner/operator is using the correct standards and duration.

Line 5: Because of the statistical nature of this type of release detection, the owner/operator is allowed a certain amount of monthly variation. Refer to the weekly and monthly standard variation on the table below.

Line 6: Make sure you understand the Notes below regarding whether manual tank gauging is an acceptable method of leak detection. If the answers to the questions are "Yes," and the requirements for conducting MTG are met, the tank passes inspection.

Line 7: The ten-year anniversary date from when the tank was upgraded or installed (new tank) has passed. Inventory control can no longer be used as sole method of leak detection.

Tank Size, Test Duration, and Weekly/Monthly Standards

Tank Size	Minimum Duration of Test	Weekly Standard (1 test)	Monthly Standard (4-test average)
Up to 550 gallons	**36 hours**	**10 gallons**	**5 gallons**
551-1,000 gallons (when tank diameter is 64")	**44 hours**	**9 gallons**	**4 gallons**
551-1,000 gallons (when tank diameter is 48")	**58 hours**	**12 gallons**	**6 gallons**
551-1,000 gallons (also requires periodic tank tightness testing)	**36 hours**	**13 gallons**	**7 gallons**
1,001-2,000 gallons (also requires periodic tank tightness testing)	**36 hours**	**26 gallons**	**13 gallons**

Notes:

Manual Tank Gauging (MTG) may be used as the sole method of leak detection for life on USTs of 1,000-gallon capacity or less. Product level measurements must be collected at the beginning and end of a 36- to 58-hour period depending on the size of the tank (see table above). No product may be added or removed from the UST during manual tank gauging. The measuring stick must be calibrated to 1/8th-inch. The owner/operator averages two stick readings at the beginning and end of the 36- to 58-hour period.

For tanks between 1,001 to 2,000 gallons, an owner/operator may use manual tank gauging and a tank tightness test conducted at least every 5 years until 10 years after installation or upgrade. For tanks over 2,000 gallons, an owner/operator may not use manual tank gauging.

MTG is a short-term test in a static (closed) tank. It differs from Inventory Control, which requires daily recording of volume in an active tank, and keeping track of additions and withdrawals. In MTG, tests are conducted by gauging the volume with a gauging stick once a week and lasts at least 36

hours. Four measurements must be taken: ,two at the beginning of the weekly test, and two at the end. The tank volume must not be disturbed during the test period.

A calibration chart specific to the tank is used to convert product level measurement into product volume. The average of the final two measurements is subtracted from the average of the first two to obtain the change in product volume over time. The calculated product volume change is compared to weekly and monthly standards (above). If the volume change exceeds these standards, the tank may be leaking. If the owner needs assistance in conducting MTG, refer to the EPA publication *Manual Tank Gauging For Small Underground Storage Tanks.* The manual is downloadable from the EPA's website: http://www.epa.gov/swerust1/pubs/index.htm.

MTG works best with heavier fluids such as waste oil and diesel because the measurements are easy to read on the gauging stick and these fuel types are not sensitive to temperature changes.

A leak is suspected if the variation between the beginning and ending measurement is greater than the weekly or monthly standard listed above. Remember, if the groundwater level is higher than the product level in a leaking tank, it may create pressure on the outside of the tank that can hide a release.

Common Problems and Errors: Manual Tank Gauging

- Method can no longer be used (for 1,001 – 2,000-gallon USTs)
- Not gauging tank at required times
- Not reconciling at the end of the month (this is what indicates a leak)
- Tank is too large for method

Section 6.g. Groundwater Monitoring (Tank and Piping) [567--IAC 135.5(4)f]

Fill out this section if Groundwater monitoring is used for tanks and/or piping

Answer Yes or No for each tank		Tank #	Pipe #	Tank #	Pipe #	Tank #	Pipe #	Tank #	Pipe #
1	Regulated substance stored does not mix with water (floats on surface of water)								
2	Well was opened and groundwater was observed/measured not more than 20 feet from the ground surface								
3	Wells are sufficient in number and placement to adequately detect leaks. Wells intercept the tank pit (backfill) and are as close to the tanks as technically feasible								
4	Static water level is within the screened interval of the well								
5	Manual or automatic monitoring is used and the results recorded at least once per month								
6	Method used								
7	Monitoring wells are clearly marked, undamaged and have adequate wellhead protection.								
8	Past 12 months of records are available and acceptable								
Existing release detection results show no evidence of a release.									

Line 1: Low volatile fuels and fuels miscible with petroleum are not appropriate for groundwater monitoring. Gasoline floats on the surface of the water making it evident that a release occurred.

Line 2: In order for groundwater monitoring as a leak detection method to be effective, the groundwater must not be more than 20 feet below the surface. Use an interface probe or metal tape with water paste to determine groundwater level. The interface probe will also detect the presence of product and the amount of product on the surface of the water.

Line 3: Groundwater monitoring wells should not be spaced more than 20 feet apart if they are to effectively detect a release.

Line 4: If the groundwater level does not reach the screened portion of the well, detection of a release from the tank or piping is unlikely.

Line 5: Manual devices such as a bailer are used to visually inspect for product. Electronic devices such as an interface probe detect the presence and depth of product. Other electronic devices may be installed for automatic and continuous measurements. The owner/operator must use either

manual or electronic devices at least once per month and record the results. Make sure the record is complete, such as date, time, temperature, observation and observer.

Line 6: Indicate which detection device is used.

Line 7: Well caps must be secure and clearly marked. To ensure effective monitoring and protect groundwater, well covers must be clearly marked and secure. If well caps are missing or damaged, it is a deficiency and must be corrected.

Line 8: If any of the questions to this section is "No," then groundwater monitoring may not be suitable or acceptable. If you are in doubt about the appropriateness of groundwater monitoring for a particular site, contact the DNR Tank Section.

Notes:

Groundwater Monitoring – Much of what is said about vapor monitoring in the next section can also be said for groundwater monitoring (e.g., well construction, spacing, radius of detection, porous backfill, etc.) Groundwater monitoring may be performed when groundwater is no greater than 20 feet below ground surface. The well screen must be set above the seasonable high-water table to be capable of detecting free-floating product.

Groundwater monitoring must be capable of detecting at least 1/8th-inch of product on the water table. Wells must be sufficient in number to detect a release from any portion of the tank, and the backfill must be porous to allow product to migrate to the wells. This requires the owner or operator to maintain on site a monthly monitoring record (similar to vapor monitoring with the exception of numbers 6 and 8 above). The owner should also have available boring logs of the groundwater monitoring wells to ensure the site conditions and location of the monitoring devices comply with 135.5(4)"f". Make sure groundwater monitoring wells are clearly marked with covers secured. If not, give the owner/operator a deadline to get them repaired.

Section 6.h. Vapor Monitoring (Tank and Piping) [567--IAC 135.5(4)e]

Fill out this section if Vapor monitoring is used for tanks and/or piping

Answer Yes or No for each tank		Tank #	Pipe #	Tank #	Pipe #	Tank #	Pipe #	Tank #	Pipe #
1	Regulated substance vaporizes readily even in cold weather conditions								
2	Wells are sufficient in number to adequately detect vapors from releases from any part of the tank(s)/piping								
3	Manual or automatic monitoring is used and the results recorded at least once per month. Vapor monitor equipment used:								
4	Method used								
5	Wells are properly placed and constructed within the backfill to adequately detect vapors from releases from any part of the tank(s)/piping								
6	Wells are not damaged and clearly marked and secured to prevent unauthorized access and tampering								
Monitoring results show no evidence of a release									
Vapor monitoring passes inspection. Questions 1-6 are acceptable and applicable									

Line 1: The substance stored must vaporize easily. Low-volatile fuel is not appropriate for vapor monitoring.

Line 2: Similar to groundwater monitoring, vapor monitoring wells should be close enough to the tank and/or piping and sufficient in number to detect a release quickly.

Line 3: Detection devices may be manual or permanently installed to continuously or periodically monitor for the presence of vapors. Manual systems may immediately analyze a gathered vapor sample, or the sample may need to be sent to the lab for analysis.

Line 4: Indicate which method is used.

Line 5: Wells must be sufficient in number to detect a release quickly, and the backfill sufficiently porous.

Line 6: As with groundwater monitoring, wells must be clearly marked and secure. If there is no evidence of a release and questions are acceptable, vapor monitoring passes.

Notes:

Vapor Well Monitoring (VWM) – There are few VWM sites in Iowa compared to other RDM methods. To conduct vapor monitoring correctly is complex and demanding; and in the end, its effectiveness is still in doubt.

To begin, when you inspect a VWM site, ask yourself: Are the wells sufficient in number so they can detect a release from any portion of the tank system within 30 days? Obviously, the product stored must be sufficiently volatile to be detected. Gasoline is easier to detect than diesel due to its high vapor pressure. Temperature must also be considered. The colder the temperature, the less volatile a substance becomes, thereby decreasing the chance of detecting a release. Obviously, monitoring wells must extend below the frost line if they are to have a chance of detecting a release. Moreover, the static water level must be at least two feet below the lowest component being monitored, as saturated conditions inhibit vapor diffusion/movement.

The wells for groundwater and vapor monitoring must be sufficient in number. The ideal well spacing in the backfill is within 10 feet of any potential leak point. This means wells would be spaced no more than 20 feet apart, and each well would have a radius of detection of 10 feet. Wells spaced no more than 20 feet apart and installed as close as possible to the tank or the component being monitored would have the best chance of detecting a release.

The backfill must be sufficiently porous to readily allow diffusion of vapors from releases into the excavation area. The backfill in which the well is installed must be permeable (loosely packed, large-grained materials such as pea gravel or large-grained sand). If there is doubt about the permeability of the backfill (i.e., if boring logs are not available), the owner/operator must demonstrate appropriate backfill material by contracting with a Certified Groundwater Professional (CGWP) or licensed well contractor to install a boring or a vapor monitoring well to document the appropriate backfill material. A tracer test may also be used that mimics the movement of the volatile constituents of the product through the backfill.

In piping trenches, vapor monitoring wells should be located at all piping joints and where piping changes direction (Flex piping would warrant a different arrangement). VMWs should be placed at each dispenser island and in locations least likely to be affected by surface spills caused by vehicle overfilling. Also, additional wells may be needed along a straight length of piping depending on the length to comply with the radius of detection.

Well depth must be no greater than 20 feet below ground surface. The well screen typically begins from two feet below ground surface for tank monitoring and one foot below ground surface for piping trench. The well casing must be at least two inches in diameter and usually constructed of PVC pipe without joints. The filter pack (clean quartz sand) should extend 1 to 2 feet above the well screen. Several inches of filter pack are placed in the bottom of the borehole before the well casing is installed. The annular seal (surface water barrier) usually extends for 1 to 2 feet above the filter pack. A concrete seal is placed above the annular seal up to the ground surface to provide additional protection to the well casing from contamination and physical damage. Finally, the well must be covered, identified as a monitoring well (black equilateral triangle on a white background and a durable label, warning against accidental or intentional introduction of petroleum products into the well) and secured (lockable and water tight).

The monitoring device should be capable of detecting >500 ppm TPH and 50 ppm diesel/kerosene and differentiating between background concentrations and a release. If background vapors are high (1,500 ppm) or if the site is an active LUST site, vapor monitoring is not recommended. A release

may be identified anywhere between 1,500 and 4,000 ppm. If you haven't already figured it out, VWM is a rather unreliable method of leak detection, and should be treated with suspicion.

Monitoring devices may include portable instruments such as Flame Ionization Detector (FID), Photo Ionization Detector (PID), Combustible Gas Instrument (CGI) and Colorimetric or detector tubes. Calibration must be performed at each facility before each testing event. Ask for the document *Vapor Monitoring Guidance* from the Central Office for further information regarding monitoring devices and VWM as an RDM.

Section 6.i. Automatic Line Leak Detectors (Pressure Only) [567--IAC 135.5(5)a]

#	Select type of equipment present; then answer each question Yes or No	Pipe #	Pipe #	Pipe #	Pipe #
1	Brand/Model				
2	Restrictor (Manual)	☐	☐	☐	☐
	Automatic Shutoff (Electronic)	☐	☐	☐	☐
	Audible or visible alarm (Electronic)	☐	☐	☐	☐
3	ALLD function test passes in accordance with manufacturer's requirements in last 12 months (B)				
4	If device can perform 3 gph @ 10 psi, last 12 months of tests available or				
	If device performs 0.2-gph monthly test, last 12 months worth of test results available, OR				
	If device performs 0.1-gph annual test, last test result available.				
5	Equipment meets third party evaluation performance standards.				
6	ALLD shows no evidence of release.				
Automatic Line Leak Detectors Pass inspection. Questions 1-6 as acceptable.					

This section should be filled out for systems that have pressurized piping systems with a mechanical or electronic automatic line leak detector.

Line 1: List the type of ALLD by make and model for each tank if different.

Line 2: Specify whether each device activates a shutoff, flow restrictor or alarm.

Line 3: Mechanical ALLD Only: Automatic line leak detectors must be tested annually to make sure the equipment is functioning properly. Tests are specified per manufacturer. The principle of the function test is to induce a small leak in the line at a known rate and see if the ALLD catches it. If the ALLD has not been tested in the last year, answer "No" to this question. Have the owner get the device tested.

Line 4: Check all the options that apply for the leak rate and verify the records are available.

Line 5: An automatic line leak detector may only be used if it is evaluated by a third party evaluator and found to meet minimum industry performance standards. There are two ways to determine third

party evaluations: either ask the owner to provide you with a copy or check the website for the National Work Group on Leak Detection Evaluations for UST Systems (NWGLDE): http://nwglde.org. The website edition of the list is updated continuously, but is not easily downloadable. The downloadable edition of the list is updated only once a year. It is a good idea to have a copy with you during inspections.

Line 6: Based on the results of the ALLD, indicate whether or not there is evidence of a release or suspected release from each pipe. If the LLD has been tripped or activated, this is a suspected release and should be investigated and noted on the form. This applies for any leak rate: 3.0, 0.2 or 0.1 gph.

Line 7: Based on an answer of "Yes" to questions 3-6, the ALLD. If any of these answers is "No" the release detection system does not pass inspection.

Notes: A stand-alone sump sensor used as the sole source of leak detection for double-wall piping is not allowed. Sensors are not reliable as a sole source of leak detection for piping. PEI issued a warning in 2000 to discourage stand-alone sump sensors for new installations, noting these systems have been responsible for "substantial releases." It has also been reported that a stand-alone sensor cannot meet the requirement of being able to detect a 3.0-gph leak at 10 psi within one hour.
If owners/operators are using stand-alone sensors with no ALLD, advise them to have a LLD installed.

Common Problems and Errors: Automatic Line Leak Detectors

- Not installed or installed incorrectly
- Not maintained or calibrated
- Not tested annually
- Not meeting standard of 3 gph leak rate at 10 psi
- Not having documentation of the monthly 0.2 gph test
- Not functioning
- Sub pump housing and line leak detector is buried in backfill

Section 6.j. Safer Suction (Suction Piping Only) [567--IAC 135.5(2)b(2)]

Fill out this section to verify that the suction piping system does not require release detection.

#	Answer with Yes or No for each pipe	Pipe #	Pipe #	Pipe #	Pipe #
1	The piping slopes back to the tank and operates under atmospheric pressure or less.				
2	The only check valve is directly under the dispensing pump.				
Safer Suction passes inspection. Questions 1 and 2 are acceptable.					

No release detection is required for piping operating under a Safer Suction system provided the owner/operator can document that all of the following apply:

a. The piping operates at less than atmospheric pressure;
b. The piping is sloped so that the contents will drain back to the UST if the suction is released;
c. Only one check valve is included in each line, and located at the dispenser;
d. The check valve is located as close as possible to the pump.

How does one ensure the product line is Safer Suction? It is difficult to tell with older systems because that information was not available with the registration. If the subsequent inspections did not document Safer Suction piping, you may need to require the owner/operator to break the suction while in your presence to verify the product drains back to the UST, or have a technician verify the system is safer suction. Many lines have a second check valve at the UST or the lines are not sloped back to the UST due to site topography and, thus, this exemption will not apply.

Section 7. Spill Protection Device [567--IAC 135.3(1)]

#	Answer Yes or No for each tank	Tank #	Tank #	Tank #	Tank #
1	Equipped with spill bucket of at least 5 gallons capacity.				
2	Size of spill bucket (estimate if not available)				
3	Bucket clean and free of debris and water/ice				
4	Bucket appears liquid tight with no cracks, holes.				
5	Bucket is functional, intact with no deformation or separation from the fill pipe				
6	Spill device not required. Tank that receives less than 25 gallons of petroleum per delivery is not required to have a spill device.				
Spill Device Passes inspection. Questions 1 and 3-6 are all acceptable.					

Lines 1-2: Confirm through visual inspection the spill bucket is present. Estimate the size.

Line 3: The spill bucket must be free of debris, water and dirt or it is not doing its job, and the tank does not have a usable spill device. If the owner cleans the bucket during the inspection, then mark this question with a "Yes," but note under Corrections that the bucket was cleaned.

Lines 4-5: Make sure the spill bucket has no obvious signs of cracks, holes or other damage that could render the device unable to contain product. A damaged spill bucket can fail inspection if it cannot contain product as designed.

Photo 6

Photo 7

Spill buckets are not supposed to store liquid, but must be kept clean and emptied expeditiously. Photos 6 and 7 show spill buckets that are useless for spill prevention under such conditions.

Photo 8

Photo 9

Photo 8 shows a new spill bucket and cover (with seal) and special collar with drainage slots. This spill bucket was installed to comply with compatible equipment for E85. Photo 9 illustrates a spill bucket collecting runoff.

Notes: Spill buckets are one of the major causes of releases, not just because of overfills from transporters, but because the buckets themselves are not liquid tight. They may be corroded, cracked, split and otherwise deteriorated. Spill buckets made from high-density polyethylene (HDPE) can degrade from exposure to petroleum. Spill buckets were not made to last the life of the tank system, but approximately 7 years. This means that spill buckets installed before the upgrade deadline of 1998 have approached the end of their useful lives. Take time to determine if the spill bucket is intact and liquid tight, especially on older ones.

Common Problems and Errors: Spill Buckets and Sumps

- Spill bucket lid is not tight or sealed correctly
- Spill bucket contains debris or liquid
- Spill bucket has crack or holes and is not liquid tight
- Sump walls liquid tight but not intact (warping, caving)

- Sump walls are cracked or have holes and cannot contain liquid
- Sump walls are stained since last inspection
- Sensors are not positioned correctly (in the lowest part of the sump and below piping entry)
- Penetration seals into the sump are cracked or loose
- Test boots are not positioned correctly and are not in good condition
- Piping is in poor condition (corroded--if steel, swollen, cracked, soft, spongy, degraded, kinked, spongy, distorted)
- Flex connectors are kinked, bent, twisted, cracked (see photo in STP Sumps section)

Section 8. Overfill Prevention Device [567--IAC 135.3(1)c]

#	Check all that apply and answer Yes or No for each tank	Tank #	Tank #	Tank #	Tank #
1	**Overfill device present and functional (use 2 and 3 if more than one overfill device is present)**				
2a	**Select overfill device present**				
2b	**If second overfill device present, select device**				
2c	**If third overfill device present, select device**				
3	If alarm is selected**: Alarm is checked annually (or in accordance with the manufacturer's recommendation) and functioning properly at 90% and is audible or visible to the driver**				
4	**Visual observation indicated no obstruction in the drop tube that would render the shut-off device ineffective**				
Overfill Device Passes inspection. Question 1 (and 5 and 6 applicable) are acceptable.					

Line 1: Confirm through visual inspection the tank has an overfill device, and select which type is present for each tank. If visual inspection cannot be done, use another means of evidence that an overfill device was installed based on owner or operator information (receipt, invoice, warrantee, photos, record, etc.)

Lines 2a-2c: Select overfill device present. Use Lines 3 and 4 if second and third overfill device present.

Line 3: The high-level alarm should be tested per manufacturer's specifications. Make sure the device operates at its required 90 percent capacity. An inspector should also make sure the alarm can be seen or heard by a driver during delivery. If not, the alarm should be relocated where it can be seen or heard by the driver. Otherwise, the overfill device fails inspection.

Line 4: Inspectors have noted sticks inserted in the overfill drop tube, disabling the automatic shutoff device. Visually inspect the drop tube to ensure there is no obstruction. If the device is disabled, it fails inspection. Correct the problem during the inspection, if possible, and notify the owner/operator that a disabled drop tube can cause an overfill.

NOTES: PEI/RP 100-2000: Vent restriction devices/ball float valves must not be installed in storage systems with 1) pump deliveries, 2) suction pumps and air eliminators, 3) coaxial Stage 1 vapor recovery (unless special fittings are installed), 4) remote fill pipes and gauge openings. Vent restriction devices should not be installed on emergency generator tanks or heating oil tanks (p. 13). If the inspector encounters such an installation, the owner/operator must remove or disable the device and replace it with an appropriate overfill device.

Common Problems and Errors: Spill and Overfill Problems

- Not measuring the tank before each delivery to ensure there is ullage adequate for product
- Not monitoring the fuel transfer
- Inventory stick inserted in fill pipe during delivery to bypass overfill device
- Flapper valve disabled or removed
- Alarm disconnected
- Alarm sensor set higher than 90%
- Overfill float set higher than 95%
- Inventory stick inserted in fill
- Ball float valve installed on suction system with air eliminator
- Ball float valve installed on pressurized delivery
- Ball float installed on remote fill tank

Section 9.a. Corrosion Protection (Galvanic) [567--IAC 135.4(2)]

	Galvanic Cathodic Protection	Tank #	Tank #	Tank #	Tank #
1	**Date of most recent CP test.**	/ /	/ /	/ /	/ /
2	**Tank passed test in accordance with NACE Standard RP-0285 within the last three years.**				
3	**Pipe passed test in accordance with NACE Standard RP-0285**				
4	**Metal connections at tank and dispenser are cathodically protected or not in contact with soil or other electrolyte**				
5	**Record of last two cathodic protection tests on file with owner or operator.**				
6	**Galvanic Cathodic Protection passes inspection. Questions 2-4 are acceptable.**				

Use this section to summarize the inspection information about the Galvanic corrosion protection system. UST systems (tanks/piping/equipment) must be protected from corrosion in order to prevent a release [567--135.3].

Lines 1 and 2: CP testing must be completed every three years for galvanic and impressed current systems. Make sure the tanks have been tested within the three-year period and enter the date of the last test. If the tanks have not been tested or the cathodic protection test failed and was not repaired and retested, the cathodic protection fails inspection.

Line 3: Same as above except for piping.

Line 4: It is not uncommon to see an unprotected flex connector or other metallic connections in contact with the electrolyte or backfill. Make sure these connections are either protected or isolated from the backfill.

Line 5: The owner/operator must provide the inspector with the results of the last two cathodic protection tests, if applicable. The owner/operator should at a minimum have the most-recent cathodic protection test.

Galvanic Cathodic Protection Passes Inspection. Based on an answer "Yes" to questions 2, 3 and 4, the galvanic system passes inspection. If any question is "No," the galvanic system fails inspection.

Section 9.b. Corrosion Protection (Impressed Current) [567--IAC 135.4(2)]

	Impressed Current Cathodic Protection	**Tank #**	**Tank #**	**Tank #**	**Tank #**
1	**System has power, is turned on and operating within normal ranges.**				
2	**System tested and passed within last three years in accordance with NACE Standard RP-0285**				
3	**Date of most recent CP test**	/ /			
4	**Rectifier setting (if applicable)**				
5	**Rectifier Amps**				
6	**Rectifier Voltage**				
7	**Rectifier hours displayed.**				
8	**60-day log is present and filled out properly.**				
9	**Metal connections at tank and dispenser are cathodically protected or not in contact with soil or other electrolyte**				
10	**Pipe passed test in accordance with NACE Standard RP-0285.**	/ /	/ /	/ /	/ /
11	**Record of last two cathodic protection tests on file with Owner or Operator.**				
12	**Impressed Current Cathodic Protection Passes Inspection. Questions 1, 2, 8, 9 and 10 are acceptable**				

Lines 1 and 2: Confirm the system is operating and has passed the most recent cathodic protection test.

Line 3: Enter the date of the most recent CP test.

Lines 4-7: Indicate the results of the current rectifier settings. Compare these settings with the last test for any significant changes.

Line 8: Have the owner/operator provide you with the 60-day log. If this has not been entered, it is not grounds for inspection failure, but should be noted on the inspection report. The 60-day log ensures the owner/operator inspects the rectifier for proper operation, usually indicating the rectifier is "On" and operating within normal range.

Lines 9-10: It is not uncommon to see an unprotected flex connector or other metallic connections in contact with the electrolyte or backfill. Make sure these connections are either protected or isolated from the backfill.

Impressed Current Cathodic Protection Passes Inspection. Based on an answer "Yes" to questions 1-2 and 8-10, the impressed current system passes inspection. If any question is "No," the impressed current system fails inspection.

Notes: If you are a NACE-certified tester or are skilled and competent in testing galvanic or impressed current systems, you are encouraged to do so during the inspection and report the results.

Common Problems and Errors: Cathodic Protection

- Significant changes in output since last inspection
- Power off to IC system
- Steel pipe unprotected
- Not recording IC system operation every 60 days
- Not conducting a CP test within six months following the installation of the cathodic protection system
- Not conducting a CP test every three years
- Fill or vent not dialectically isolated from sti-P3 tank
- Not correcting system after it had failed or problem developed
- Damaged cables on IC system, improper burial depth, cable exposed or not testing after construction or excavation
- Irregular or non-uniform readings for IC system
- Flex connector in contact with ground and unprotected

Common Problems and Errors: Rectifiers (from NACE International)

- Listen for unusual noises
- Look for signs of heat (discoloration)
- Look for vent obstructions
- Look for significant output changes
- Smell for unusual odors (examples: rotten egg-selenium failure, ozone-insulation failure, burning-insulation failure)
- Feel for unusual heat (turn off power before touching live components)

Common Problems and Errors: Rectifier Output (from NACE International)

- Zero current and voltage outputs (no input power to the unit or an open circuit)
- Zero current output with unchanged voltage output (open fuse in the output circuit, an open positive or negative lead wire or a failed groundbed)
- Significant current change with unchanged voltage (lower circuit resistance due to interference from other underground structures, coating damage, system additions
- Higher current output (higher circuit resistance due to groundbed deterioration, disconnection of system component, seasonal variations in soil conditions)
- Significant changes in both voltage and current outputs (one-half of normal values) could mean partial failure of the rectifier stacks[1]

Section 9.c. Corrosion Protection (Internally Lined Tanks) [567--IAC 135.4(2)]

Internally Lined (Tanks Only with no CP)		**Tank #**	**Tank #**	**Tank #**	**Tank #**
1	**Date liner installed (Month/Day/Year)**	/ /	/ /	/ /	/ /
2	**Date of last inspection (Month/Day/Year)**	/ /	/ /	/ /	/ /
3	**Results of Liner Inspection**				
4	**Liner inspected in a timely manner (within 10 years after installation, every 5 thereafter)**				
5	**Metal connections at tank and dispenser are not in contact with the soil or other electrolyte**				
6	**Next Inspection due date. (Month/Day/Year)**	/ /	/ /	/ /	/ /
Internally Lined Tanks pass inspection. Questions 3 through 6 are acceptable.					

To meet corrosion protection requirements, a tank may be equipped with a cathodic protection system, internally lined or both, or constructed of a non-metallic material. A liner requires inspection every ten years after installation and every five years thereafter. If an UST system has both cathodic protection and internal lining, the periodic inspection of the lining is waived if the cathodic protection was installed within one year after the tank was lined.

Lines 1 and 2: Enter the installation date of the liner and the date of the last inspection. This information is based on information provided by the owner/operator and other records.

Lines 3 and 4: Did the inspection result in a “Pass” or “Fail”, and was it inspected within the time allowed?

Line 5: If this is a lined tank only with no cathodic protection, it might be easy to overlook unprotected flex connectors and piping that are not protected and exposed to the backfill.

[1] **CP Tester Upgrade Manual. NACE International, January 2002, 9:12**

Line 6: Let the owner know when the inspection is due. Calculate from when the last internal inspection was conducted. After the first inspection (10 years after installation of the liner), all inspections are every five years.

Internally-lined tanks pass inspection: Based on the answer "Yes" to questions 3 and 4, the internal lining passes inspection. A "No" answer to question 5 means the tank line fails cathodic protection.

Note: When neither galvanic nor impressed current sections are completed, the tank is by default constructed of non-metal material such as fiberglass or fiberglass clad steel. Piping is constructed of fiberglass or flexible plastic, which is also indicated in Section 4.

Section 10. Dispensers, Dispenser Sumps and Containment/Transitional Sumps

		Tank #	Tank #	Tank #	Tank#
1	**Dispensers inspected and not dripping or leaking**				
2	**Dispenser sumps liquid tight (free of liquid, ice, cracks and holes) and intact**				
3	**Containment sumps inspected (free of liquid, ice, cracks and holes) and intact**				
4	**Penetrations into the sumps in good condition**				
5	**Test boots are positioned correctly and in good condition**				
6	**Tank system appurtenances/equipment that are located in sumps are not leaking**				
7	**Piping and flex connectors in the sumps are in good condition**				
8	**Dispensers and containment sumps pass**				

Line 1: Connections in the dispenser must be tight, not dripping or leaking. If you observe a leak or drip, tell the owner/operator to shut off the pump until it is repaired.

Lines 2 and 3: If sumps are present, they must be liquid tight and intact.

Line 4: Check to ensure all areas where electrical wires, conduits, and piping enter the sump are sealed. Cracked or loose seals around the penetrations can allow liquids to enter the sump and can allow fuel to be released into the surrounding soils if a release occurs inside the sump.

Line 5: A test boot is found on secondary containment piping, and is a flexible sleeve usually made of rubber with a valve located either at the entry to the sump or on the piping in the sump. It is used to test the space between the inner and outer pipe walls for tightness. Check to ensure the test boots are in good condition, not cracked or torn, and positioned correctly in the sump. Test boots should be positioned so they allow product to enter the sump if a leak from the primary pipe occurs.

Line 6: Turbines have been known to leak at the flange where they are connected to the tank. They also have been known to become severely corroded. Make sure they are not damaged or leaking.

Check all the equipment such as **leak detection equipment, turbines, line leak detectors and flex connectors to ensure they are in good shape and not leaking.**

Line 7: Check to make sure the piping is not corroded or degraded. This includes flex, steel and fiberglass piping. Any signs of flex piping bulging, swelling, growing, having become discolored, soft, spongy or otherwise distorted, must be noted. Flex connectors should not be kinked, cracked or bent at a severe angle.

Line 8: If the shaded items are answered "Yes," the dispensers and containment sumps pass.

Section 11. Compliance Inspection Results

Facility Name	Registration			
Owner Operator				
Compliance Certification (Yes, No or NA)	Tank #	Tank #	Tank #	Tank #
Notification Requirements [567 IAC 135.3(3)				
All applicable tanks registered [135.3(3)]				
Tank tags attached to fill ports [135.3(5)]				
General Record Keeping (installation, repairs, closure, availability, etc.) [135.4(5)]				
Financial Responsibility current [136]				
Leak Detection Monitoring [135.5(1)]				
Leak Detection (Tank) [135.5(4)]				
Leak Detection (Piping) [135.5(5)]				
Leak Detection Record Keeping [135.5(6)***]**				
Release Prevention				
Spill Prevention **(Tank)** [135.3(1) c.(1) or 135.4(1)]				
Overfill Prevention **(Tank) [**135.3(1) c.(1) or 135.4(1)]				
Operation and Maintenance				
Corrosion Protection **(Tank)** [135.4(2)]				
Corrosion Protection **(Piping)** [135.4(2)]				
Corrosion Protection Record Keeping [135.4(5)]				
Compatibility [135.4(3)]: UST system is compatible with substance stored				
INSPECTOR:			**DATE** / /	
OWNER/OPERATOR			**DATE** / /	

Corrections:

Recommendations:

Notes: Complete Section 11 upon concluding the inspection. This is the only page the owner/operator must receive. Either print a copy on site from your own printer, or send a copy to the owner/operator via e-mail or hard copy. This section will be populated when the inspection is finished on the web application. Indicate corrections and any recommendations that would improve compliance, operation and maintenance of the UST system. Both the inspector and owner must sign and date the report. Explain to the owner/operator that by signing the report, he/she agrees that they have been briefed on the inspection and told about all deficiencies, corrections and recommendations.

Section 12. Addendum

This section has been added to the Inspection Form to allow for documentation of corrections to an UST system after the initial inspection is completed and submitted to the owner/operator and the DNR. This section is used only if a UST system failed the initial inspection and follow up work is necessary. If the deficiency is corrected before the 60-day deadline, but after the initial inspection, complete the form below and provide a copy to the owner/operator and an electronic copy to the DNR.

UST System Correction Information

Facility Name	
Facility Registration	
Facility Address	
City/Zip	
Identify correction (e.g., tank #, piping, spill bucket)	
Describe the work completed.	
Who completed the work?	
Was the work completed to your satisfaction?	
Did the work completed require a follow-up visit to the site?	
Date of follow-up visit (if applicable)	**/ /**
Date work completed	**/ /**
Name of Compliance Inspector	
Signature of Inspector	

Deficiencies

A final word about deficiencies or violations: If any of the required items under Chapters 567--135 (UST Technical Standards) and 136 (Financial Responsibility) were out of compliance during the inspection and not immediately corrected (i.e., during the inspection), a violation or deficiency should be issued to the owner/operator. The issuing of the violation/deficiency serves two purposes:

- The owner/operator is notified that his/her facility has specific non-compliance issues, and that further enforcement/fines/penalties may result if these deficiencies are not corrected in the specific time frame.
- The creation of a written, dated document, which records the fact that the facility has been inspected and violations were found.

The deficiency notice for underground storage tank compliance consists of the one-page inspection certification sheet which notifies the owner a violation has been discovered. explains the violation, and sets a time period for resolving the violation. The inspection certification is provided to the owner/operator immediately or within 10 days of the inspection.

Follow-up Visits

Remember: It is your responsibility to "track" the responses (resolution date) and to determine whether the information submitted sufficiently addresses the violations or requirements. Sometimes a follow-up visit will be required to ensure the corrections were made. If you need to make a follow-up visit, contact the owner/operator to arrange it. If he doesn't agree, contact the DNR**.**

Chapter 4: The Inspection

When arriving at the site, park your car close to the tank field (for lugging equipment), but be careful not to block the traffic flow or impede sales.

Always identify yourself to the owner/operator; give them your business card. Explain to owner/operator that you are going to perform an underground storage tank compliance inspection, which involves a physical inspection of the tank system and review of the records.

You may view the records before or after the physical inspection, whichever you prefer. Be courteous, and professional. *Owners and operators of UST systems must cooperate fully with inspections, monitoring and testing conducted by the department, as well as for document submission, testing and monitoring [135.4(5)].*

Beginning the Inspection

Ask for the tank registration form (always carry a blank copy of a registration form to show the owner/operator; he/she may not understand what paperwork you want). In some cases, a language barrier may exist; having a copy can be helpful. You should have already arranged to meet with the owner/operator or to the person responsible for corrections and follow-up issues if required. During the course of your inspection compare the results of the inspection with the information already provided you (registration form, checklist and any other records).

It is not necessary to ask for financial responsibility documents unless there was a recent transfer of ownership that is not reflected in the checklist. For example, PMMIC insurance information is updated automatically on our database, and usually what is reflected on the database regarding most insurance coverage is current. Neither should you need to ask self-insured sites (e.g., Casey's) for proof of financial responsibility. Unless the date in the database is expired or information is not reflected in the checklist, you should not have to ask for these records.

Physical Inspection

The inspection must start with putting on a blaze orange or lime green traffic safety vest to begin a complete inspection of the site. Always use (and complete) your Inspection Checklist. At a minimum, note the following:

a. Do the number of tanks you see in the ground match the Tank Report?
b. Check the fill port covers and the dispensers to verify that the products stored and sold match those indicated on the Tank Report.
c. Count the number of vent pipes and record their locations on your inspection checklist. This is especially important at sites that have had or presently have service bays. Unregistered (and many times in service) USTs may be found (typically waste oil).
d. Look for unmarked fill ports in front of the bays or behind the building. These will most likely be waste oil tanks.
e. Also look for monitoring wells. You already know if the site is an active LUST site. Checking monitoring wells for free product is up to you. If you have time, check them. Call the LUST site manager and ask for a site diagram if you decide to check the monitoring wells. Field offices check them (upon a work request from the central office). It is not uncommon to discover free product in wells that had not contained any before. At LUST sites where an NFA was received, inspectors sometimes find monitoring wells that have not been properly abandoned. Note this in your inspection report. Report any wells that are not properly secured.

Tank Field

Before opening fill ports and sump covers at the tank field, secure the area using traffic cones. In many cases, the best way to close an area is to use your vehicle (as you know, drivers will run over cones). The use of the vehicle to block traffic pathways is especially helpful at truck stops and service areas. Turn on the four-way flashers. Even if you have to shut down some or all of the dispensers, your safety and that of others is first priority.

After the work area is secured, open all tank field covers. The one item you don't check may be leaking or out-of-compliance. Usually start with the fill ports, making sure the tank tag is attached to each fill port.

In the future, tank field covers will be required to be marked per API color code. Make sure the spill buckets at each fill port are present. In the case of some sites, you may find remote fill ports. Some larger sites have them in order to avoid moving the tanker. Remotes can be identified because they only have a vertical drop of about two feet and then turn towards the tank (obviously, one cannot stick a tank from a remote). Also, spill buckets are required at each remote fill; check the spill buckets for the presence of product. If some are dry while others have product present, suspect that the dry buckets may be leaking. Many spill buckets are not product tight. Inspect the spill bucket carefully and record the size of the spill bucket; if you don't know, make an estimate.

Open all submersible turbine pump (STP) and sump covers. Use a tire-marking crayon or chalk to mark the position of the cover relative to the opening (sometimes they only fit one way). Remember, as with all items at the site--if you open it, put it back the way it was. Be careful; these covers (usually steel) are heavy. Use the manhole cover puller ("meathook") in your inspection tool kit.

In many cases (especially newer sites), the covers are bolted. Use your socket set and cordless drill to remove them. You can request the station operator open the covers, but don't expect cooperation. In many cases, the attendants are instructed not to touch any of the equipment; they just sell gasoline.

Other covers are fiberglass (Fiber-Lite®) which use a special removal tool. Ask the owner/operator if you can borrow his/hers. The tool looks like an aluminum walking cane. Install it in the lock and turn clockwise; the cover can then be removed.

Some manufacturers make spring-assisted STP covers, which require turning the bolts one-half turn only. The cover will then lift by itself due to the lifting spring. Always set the safety latch on the gas strut covers before further inspection.

Safety is paramount. Make sure the cones are placed to secure the area and you are wearing your vest (a hard hat is also advisable). A long bale hook is used in Photo 10 to open the manway. Use a piece of tire chalk to mark the concrete and the steel cover, and align the marks when you replace the manway cover.

Photo 10

Pressurized Piping and Leak Detection

Once the sump covers are removed (sometimes a non-sparking hammer is required to loosen them), examine all the equipment within the sumps. Look for leaks. Are product tight sumps present? Since these sumps (usually) contain the Submersible Turbine Pumps (STPs), look for line leak detectors (LLDs). Remember, these require annual testing. You will ask for the annual function test when you return inside to look at the records. If the LLDs are vented, (look for the ¼-inch diameter copper line), make sure they are only vented to the tank test port, not the piping test port or functional element port. If they are vented to the line test port or functional element, they will not work for the required 3.0-gallon-per-hour leak detection.

If possible, determine the construction material of the product lines. Are they double wall? Sometimes it is obvious what method of line leak detection is being performed by knowing what equipment is present. Study the pictures concerning the STP sumps in this guide. There are many types of equipment associated with tank monitoring systems that are used for line and tank leak detection. One of the more commonly found items are liquid sensors, which require the presence of a monitoring system. The liquid sensors detect the presence of liquid in the product-tight sumps. Some of these sensors are discriminating, which means they can discriminate between product and water.

Usually, the sensors are present when the site uses double-wall piping (fiberglass or flex). A line leak in the primary line will run into the sump and can be detected by the sensors which are required to detect 150 gallons in thirty days (0.2 gph x 24 hours x 30 days).

Watch this next item carefully. If test boots or fiberglass reducers are present, they must be open or loose. If they are not, product can't be detected by the sensors; and as a result, the station is not doing line leak detection. These boots are only used for blocking the line interstitial area, which allows pressure testing of the primary and secondary lines. After testing, it may be overlooked that the boots are still tight. Have them opened. You may actually see product run into the sump when they are loosened!

In some cases, liquid sensors are present, but the site uses single wall piping. The sensors can detect a leak from the STP, but line leak detection is not being performed by these sensors. The site may use another form of line leak detection. Verify that line leak detection is being performed. Just because an ATG system is present, it may not be performing line leak detection.

Electronic Line Leak Detectors (ELLDs)

The STP sumps can have a second type of line leak detection equipment present which is known as line pressure monitoring or an electronic line leak detector (ELLD). The ELLD is installed where the mechanical line leak detector (MLLD) is usually located.

The ELLDs are either wired to the monitoring system or are wireless (WLLD); but in either case. they monitor line pressure (obviously for pressurized systems only). They are designed to detect catastropic leaks (3.0 gph or higher) as well as smaller leaks of 0.2 and 0.1 gph. The large leak test of 3.0 gph is performed after each dispensing operation. The smaller leak tests are performed after dispensing if there is enough time or during scheduled testing times such as opening or closing the facility or weekly or monthly. There are only a couple of ELLDs that you will come across in Iowa to detect releases in pipelines.

The Pressure Decay ELLD (or PLLD) measures a change in line pressure over time. These ELLDs are the most prevalent. Common brands for this type of ELLD are Veeder Root, Red Jacket and Campo Miller. They screw in to the port where the MLLD would be and have a black electric wire attached to them. Campo Miller ELLDs can be located at the sub-unit or under the dispenser in the 3/8" plug of the shear valve. The turbine pressurizes the line when a customer turns on the turbine at the dispenser. After the customer is finished dispensing product, the turbine is turned off, but pressure is maintained in the line by a check valve. The test takes place while the turbine is off. (Veeder Root PLLDs are the exception performing the 0.2 and 0.1 gph line leak tests with the turbine on.) With the turbine off, the pipeline should be able to hold a constant pressure. If the pressure reduces below the manufacturer's limits, a leak is declared. This system should shut down the turbine at that point and notify the operator via an audible alarm and message on the control (ATG) panel.

Volume Displacement ELLDs are similar in appearance to PLLDs, but are distinguished by the solid copper or metal flex tube between the ELLD unit and the turbine electrical port. Volume displacement ELLDs operate similarly to the pressure decay ELLDs. When the customer is finished dispensing product and replaces the nozzle, the turbine shuts off. But the ELLD turns on the turbine and measures any additional product injected into the pipeline to replace product that may have leaked out during the test period. In a passed test or a tight product line, the line should hold the entire volume of product in the line without having any product replaced or at least no more than the manufacturer's set limits.

The ELLD shuts off the turbine when the test is completed. If the volume of product injected into the line exceeds the manufacturer's set limits, a leak is declared, the turbine is shut down and the operator notified. Volume Displacement ELLDs are distinguished from PLLDs by the metal flex tube attached to them. Typically, the ELLD looks for a three-gallon per hour leak rate. If the line passes the 3.0 gph test, the unit will test at 0.2 gph, and some units proceed to a 0.1 gph test. Incon Volume Displacement ELLDs can be found as a stand-along unit or interfaced with an Incon ATG unit. Stand-alone units and those interfaced with TS-1000 ATGs will not automatically test for 0.1 gph unless it is programmed to do so. Incon ELLDs when interfaced with ATG units (from 2001 on) will automatically test at 0.1 gph. Study the guide photographs (pp. 116-154) to help determine which type of pressure transducer or ELLD is installed. As mentioned earlier, in most cases these units are capable of detecting 3.0, 0.2 and 0.1 gph line leaks. If a pressure drop is detected, the unit will give an alarm status on the monitoring panel (ATG) and shutdown the turbine. Even the wireless units can give a panel alarm through multiplexing (two or more current flows on one wire) the 220 VAC line to the turbine. Veeder Root wireless LLD units can be identified by the copper tube leaving the unit and going to the electrical junction of the submersible, much like the Incon. Remember, other brands of ELLDs do exist, but virtually all will operate in the Pressure Decay or Volume Displacement method described above.

Understanding Line Leak Detection Systems, June 2000, by the California State Water Resources Control Board is an excellent resource for understanding line leak detection systems. If you don't have a copy contact the central office and request one.

Overfill Prevention

1. <u>Vent Restriction Devices</u>:
Additional covers located at the tank field may contain vent restriction devices or ball float vent valves which is one means of complying with overfill requirements. They are usually located near the tank ends and vent stacks. Typically (not always), the riser cap has a metal rod that connects the two ears located on the top of the cap. Again, reference the photographs in the back of this manual in the Chapter *Overfill Prevention* for examples.

Warning: Vent restriction Devices or Ball Float Vent Valves may not be used with suction systems, pumped deliveries, remote fills and in tanks with gauge openings per PEI/RP 100-2000. During an overfill with a ball float or vent restriction device engaged, product is forced out the dispenser in a suction system and any loose or uncapped opening on the tank. During deliveries if the tight fill that connects the hose to the fill port is worn, back pressure caused by the ball float vent valve could blow off the tight fill and send a geyser of product out the fill port.

In addition, vent restriction devices should not be used with emergency generator tanks. New flow restrictor installations are prohibited in the currently proposed UST rules.

2. <u>Automatic Shutoff</u>:
There are other types of overfill protection that can be observed at the tank field. Flapper valves, which are situated in the fill port drop tubes, are designed to shut off the fuel flow when the tank is at 95% of its total capacity. You can recognize this type of overfill by a metal half-moon shaped projection into the drop tube. Typically, this half moon is down at least three feet from the surface. In-tank floats can also be found in coaxial drop tubes. Look for a metal "caution" tag. OPW and EBW are common manufacturers of in-tank floats.

3. <u>High Level Alarm:</u>

Overfill alarms use probes installed in the tank to activate an alarm through the ATG system when the tank is either 90 percent full or within one minute of being overfilled. Either way, the alarm must provide the driver enough time to shut off the valve at the tanker before an overfill occurs. The alarm must be on an electrical circuit that is active all the time so the alarm will always work (especially for night deliveries when the station is closed).

A high-level alarm must be located in the tank field area where the transport driver can hear it, not in the back room of the store next to the ATG panel.

Damaged or Removed Overfill Prevention Equipment

Make sure the overfill equipment has not been tampered with by the transport driver. Reports of disabling or removing in-tank floats or auto shutoffs are not uncommon, unfortunately. Drivers have broken off gauging sticks and jammed them into the main valve of the in-tank float, preventing it from closing.

Transport drivers disable or remove this equipment to make faster deliveries. An in-tank float or auto shutoff restricts product flow through the fill pipe. Further, if an overfill occurs and the automatic shutoff engages, the driver will have to wait until the bypass valve allows the product in the hose to empty into the tank or hope people fill up cars so the level of product in the tank lowers. Finally, the valve closes off the drop tube, which makes it difficult to stick the tank after the delivery.

Owners/operators of USTs have responsibility for overfills regardless of who tampers with, overrides, damages or removes overfill equipment. Obviously, if the overfill is caused by the transport driver, the owner would seek compensation from the transporter. Under Iowa's Hazardous Conditions law, transport drivers and their employers can be held responsible for damages caused by an overfill and subject to penalties for tampering with or disabling overfill devices. (See 567 IAC, Chapters 131 & 133.)

Overfill equipment alone cannot prevent spills from occurring. Transport drivers and owners must ensure the ullage in tanks is measured before a delivery occurs, that overfill equipment is operating as intended, and the transfer of product is supervised at all times.

If you come upon equipment that has been tampered with, tell the owner/operator to get the equipment tested to ensure it works properly or get the equipment repaired or replaced.

Additional Tank Field Covers

Sometimes double-wall tanks have interstitial risers located at one end of the tank (steel tanks) or, sometimes, in the middle of the tank (more common with fiberglass tanks). Usually, these interstitial risers are two or three inches in diameter. If the risers don't have electrical sensors (no wires are observed entering the riser) open the riser and take air readings with a Photo Ionization Detector (PID). The presence of organic vapors may mean that the inner tank is leaking to the interstitial area. Have the owner/operator determine the source(s) of these vapors. Always look for leaks. Some sites have manifolded tanks (usually, regular grade), which means that two tanks are connected, but only one pump is used to move fuel to the dispensers. What appears to be a typical STP cover is actually used for the manifold piping connection. Look for the siphon break to help confirm this. Study the pictures carefully.

Corrosion Protection

Corrosion is defined by NACE International as the deterioration of a material, usually a metal that results from a reaction with its environments (NACE CP Tester Upgrade Manual, Chapter 2:1). Metal

loss or corrosion occurs when bare steel tanks are installed in a damp, well-aerated backfill (electrolyte). Before the upgrade requirements of December 22, 1998, or the interim new tank installation standards of 1986, corrosion of underground storage tank systems was one of the major causes of releases to the environment. All new steel tank system beginning in 1986 had to be installed with corrosion protection. By December 22, 1998 all existing steel UST systems (installed before 1986) had to be protected against corrosion either by adding cathodic protection, internal lining, adding internal lining and cathodic protection or replacing the tanks with a non-corrodible material.

For newer sites, the most common method of corrosion protection is to use a composite tank, which is either jacketed or coated with fiberglass. The fiberglass outer shell isolates the steel inner tank from the backfill thereby avoiding external corrosion. Fiberglass tanks and piping are also common. Steel tanks are acceptable as long as a means of corrosion protection for them is present. Items to look for that indicate the presence of a cathodic system are cathodic protection test ports (usually painted yellow) which should confirm that either sacrificial anodes (passive) or impressed current systems are present. Saw cuts and four-inch cylindrical borings may also be present indicating the locations of wires and anodes.

Look for a rectifier (a key part of an impressed current system) which, in most cases, is found in a back room of the station. Always have a quality flashlight handy. If a passive or galvanic system is present, the owner/operator must show documentation that the system is tested every three years. The impressed current system should have documentation that the rectifier is operational (every sixty days) and that the system has been tested at least every three years. Record the most recent cathodic protection test date.

Record the voltage and amperage readings from the meters on the rectifier (if meters are present). Compare these to design settings. Record the hours of operation. Impressed current systems must operate continuously to protect the UST system from corrosion.

Ask the manager for the most recent cathodic protection test results. If the manager cannot document that cathodic protection tests are being performed every three years, ask for the tests to be submitted to you within two working days (as with all records) or, if the test was not completed, within 14 days of your inspection. Make sure that the owner/operator has verification documentation for the 60-day rectifier panel tests and the three-year cathodic protection tests.

Photo 11 was taken in October 2003 after this 1988 coated tank was removed from the ground. The tank had a release of over 800 gallons through this 0.5-inch hole and some smaller ones on the tank. Corrosion holes like this one occur either naturally or from stray current. Naturally-occurring corrosion is the result of voltage differences between the corrosion cell (anodic area) and the rest of the tank (cathodic area). The voltage differences can be caused by such factors as surface irregularities (holidays, such as an imperfection in the coating), differences in the electrolyte or backfill around the structure and oxygen content. Stray current corrosion occurs when a source of external current (e.g., a protected underground gas line) causes corrosion to the structure. The rate of corrosion here is high because the anodic area is small compared to the rest of the tank (cathode); therefore, the corrosion current is concentrated. (*Photo courtesy of PMMIC*)

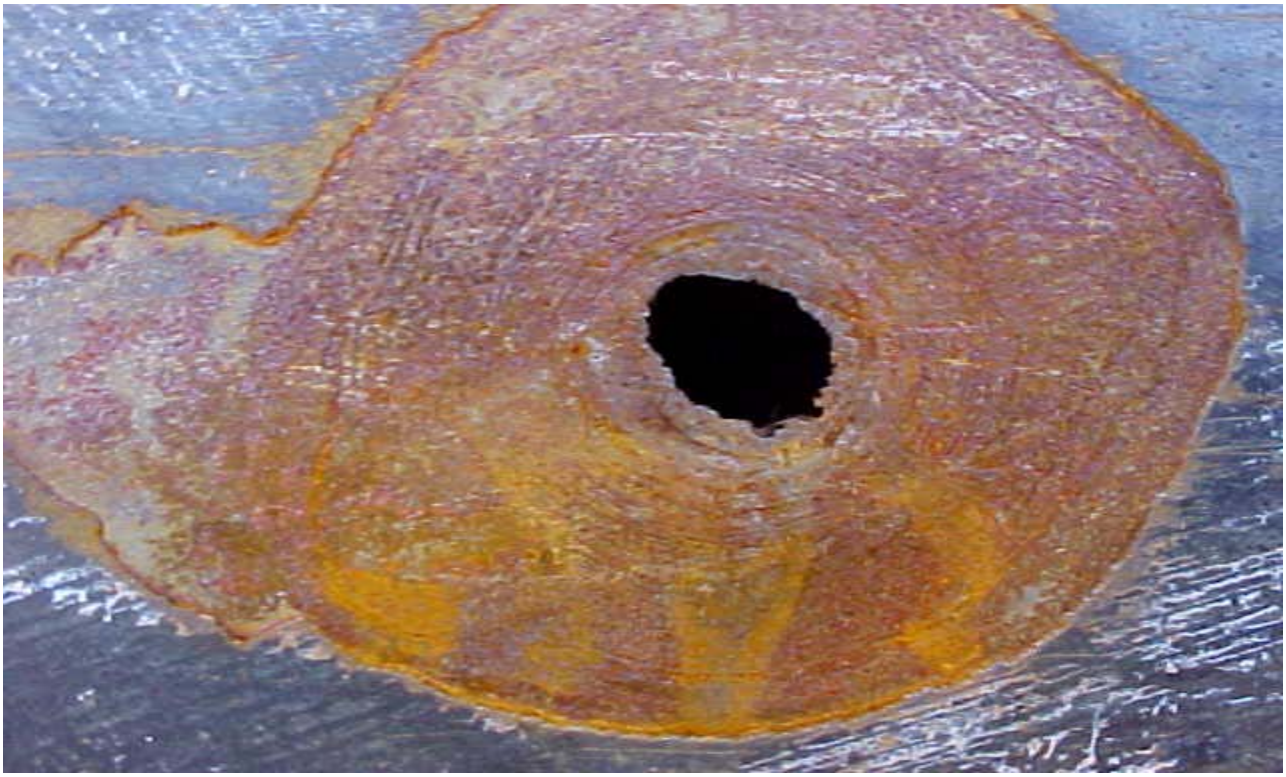


Photo 11

After April 1, 2001, all cathodic protection tests were to be conducted using the department's cathodic protection test form. Three locations (ends and center) over the tank must be tested and the reference cell must make contact with the native material. The purpose of testing the tanks is to ensure the entire structure has adequate protection. All readings must be –850 mv or more negative to be in compliance with state and federal regulations (unless 100 mv shift is used for an impressed current system). Failure of the owner/operator to have a cathodic protection tester test the cathodic protection system at least every three years is a violation.

The department references NACE Standard RP0285-95 in subrule 135.4(2) for inspecting or testing cathodic protection systems. Three test methods or criteria are presented in RP0285-95 and also in NACE Test Method 0101-2001 to comply with cathodic protection requirements on UST systems. Testers are expected to use these criteria when completing the department's UST Cathodic Protection Inspection Form. CP testing should be conducted whenever a steel tank site is inspected and the weather cooperates. We'll now explain how to conduct your own test of galvanic and impressed current systems.

Testing Galvanic or Passive CP Systems

Using your multimeter and reference cell in your UST inspector kit, test the cathodic protection system. Make electrical contact with the structure. If you can't make contact with the tank exterior, e.g., riser that's not isolated from the tank, lower the brass plumb bob to the bottom of the tank so it makes contact. Connect the male plug on the plumb bob wire to the multimeter. Connect the reference cell wire to the spool and connect spool wire to the multimeter. Set the multimeter dial to millivolts-DC. Place the reference cell over the structure to be tested and make contact with the electrolyte or backfill (clean, moist soil, not asphalt or concrete; readings on asphalt and concrete are unreliable and invalid). (Add water to the backfill material if it's dry.) Look for test ports (small diameter holes with brass covers). If test ports are not available, use the ATG system probe, sub pump/line leak detector, ball float or vent pipe manways. After making contact with the backfill or electrolyte with your reference cell, a reading should be displayed on your multimeter as a negative

number if the positive lead is connected to the tank. Record the numbers for your inspection report on the compliance inspection form (use site diagram page if you wish). If this is a galvanic system, and the readings are equal to or more negative than 850 mv, you are finished. If the measurements are less negative than –850 mv, the structure does not meet the –850 mv criterion for cathodic protection and the tank is out of compliance with the regulations. Ask the owner to have the cathodic protection system checked by a knowledgeable or certified cathodic protection tester and repaired.

Testing Impressed Current CP Systems

The only way you can understand whether a tank is adequately protected with an impressed current cathodic protection system is to measure polarization, which means you must eliminate current and resistance (IR Drop) by shutting off the rectifier or interrupting the current (Instant Off). Resistance and current are negligible on a galvanic system where the anodes are not trying to protect the entire surface of the tank (e.g., sti-P3®). On such tanks the anodes are close to the tanks, the current flowing through the electrolyte or backfill is low and the tank is well protected with a durable coating—all of which minimize interference.

The first thing to do is a continuity test. A continuity test measures the voltage of all accessible metal structures in the area that should be isolated from the structures protected by the impressed current cathodic protection system, i.e., buried piping, electrical conduit, utilities in the area, ATG probes, etc. Leave the reference cell in one location and make contact with all these structures. If the measurement is within a few millivolts of the tank measurement, the structures are electrically continuous or connected. The impressed current system should be protecting only the tank system and should be isolated from the other metallic structures.

Polarized Potential Method

Impressed current systems are easily tested with two people: one interrupting the power (shutting off the rectifier) and one recording the readings. With the rectifier or current “On”, take readings as instructed above. Record these readings as “Current On” readings. Now place your reference cell in the same locations as “Current On” and take “Instant Off” measurements. Have someone interrupt the current briefly while someone else watches the multimeter. Record the second number displayed on the multimeter after the current has been turned off. This measurement usually occurs less than three seconds after the current is shut off. If the measurement is –850 mv or more negative, the structure is adequately protected and you needn’t conduct the third test criterion, or 100 mV potential shift measurements.

100 mV Shift Method

If measurements for “Instant Off” are less than –850 mV, the potential shift or 100 mv shift criterion must be used. Often you will get measurements of less than –850 mv on poorly coated or bare steel tanks or on tanks where the current required to meet the standard would be considered excessive.

The polarized potential measurement is the starting point for the 100 mv potential shift. The instant off potential is recorded and the readings on the multimeter are monitored until there is a shift of at least 100 mv from the number that appeared when the current was interrupted. If the potential drops at least 100 mv from the polarized potential or instant off measurement, the structure is adequately protected.

Another way of approaching the 100 mv shift method is to use the native (unprotected) potential if available. If the polarized potential (Instant Off) is at least 100 mv greater than the native potential then the tank is adequately protected and the 100 mv potential shift has been met. For example, if you know the native potential for a tank is –510 mv and you determine the polarized potential is –

730 mv, the structure is still adequately protected even though the potential is less negative than –850 mv. The native potential of the tanks must be measured before an impressed current system is installed and should be available, otherwise you may not have time to complete a 100 mv shift test method. If a 100 mv shift is required, ask the owner to set it up with a knowledgeable or certified cathodic protection tester.

These are photos of a transformer-rectifier unit. Rectifiers are found on impressed current cathodic protection systems and convert alternating current (AC) to direct current (DC), which flows from the rectifier to the anode groundbed and back to the rectifier. The current (electrons) move from the anode to the cathode (the structure being protected) through the electrolyte. The voltmeter is on the left in both pictures and the ammeter is on the right. Both amps and volts should show positive values, but clearly the ammeter registers a problem. The volts read 50 and the amps 0. Troubleshooting suggests a broken negative or return cable somewhere between the structure being protected and the rectifier. A rheostat is located above the volt meter to adjust the voltage. A shunt to measure current is between the volt meter and the ammeter.

Photo 12

Photo 13

A current shunt is installed on this transformer-rectifier unit. Shunts provide a current output measurement without breaking the circuit. Shunts also yield more accurate readings than an ammeter. The shunt below (Photo 14) is a 50 mv, 10 amp shunt, which is stamped on the shunt. To measure current in millivolts, place the positive lead from the meter to the left terminal of the shunt and the negative lead to the right terminal. The measurement of 45 mv is displayed on the multimeter in Photo 15. The display shows the number as positive which means current flow is left to right. We need to determine the current in amps going out to the groundbed. We determine the current using Ohm's Law, which is the relationship between voltage and current to the resistance of a circuit. If you have two of the three variables, you can compute the third. First, we need to find the resistance of the shunt in order to solve for current; therefore, to find resistance, we use the equation R (resistance) = V (volts) ÷ I (current). Maintain the same units for the calculations (amps and volts or milliamps and millivolts) so convert 50 millivolts (shunt rating) to volts (0.05) and divide by 10 amps (shunt rating). The shunt's resistance is 0.005 ohms. Now that we know resistance, we can determine the current with the equation I = V (measured volts across the shunt) ÷ R or I = 0.045 V ÷ .005 ohms = 9 amps. Knowing the current in amps is especially helpful when the amps are unknown (0 displayed on the ammeter) or if you just want to make sure the analog display on the rectifier is accurate. An amperage of 9 is high; amps usually range from 1 to a high of 4.

Photo 14

Photo 15

After recording the rectifier's volts, amps and hours, and measuring current, go outside and take potential readings over the tanks with your copper/copper sulfate reference electrode or half-cell (it's half of the circuit; the electrolyte and tank are the other half, hence, half-cell). Copper/copper sulfate reference electrodes are the most stable reference metal and give the most accurate voltage measurements for buried steel structures. What you are measuring with the half-cell is the voltage or potential between the electrolyte and the structure with the half-cell in contact with the electrolyte. The measurement will indicate whether the structure is adequately protected by the impressed current system. In other words, the reference cell or electrode or half-cell, when in contact with the electrolyte, measures the voltage between the structure and the electrolyte to determine whether the voltage is adequate to overcome the corrosion current. Further, the reference electrode, being stable and accurate, allows one to compare readings from structure to structure.

In Photo 16, the inspector connects the lead that makes contact with the structure to the positive terminal of the multimeter. In Photo 17, the inspector plugs in the lead that connects to the reference electrode into the negative terminal of the multimeter. There is an electrode extension in the right photo sticking out of the manway.

Photo 16

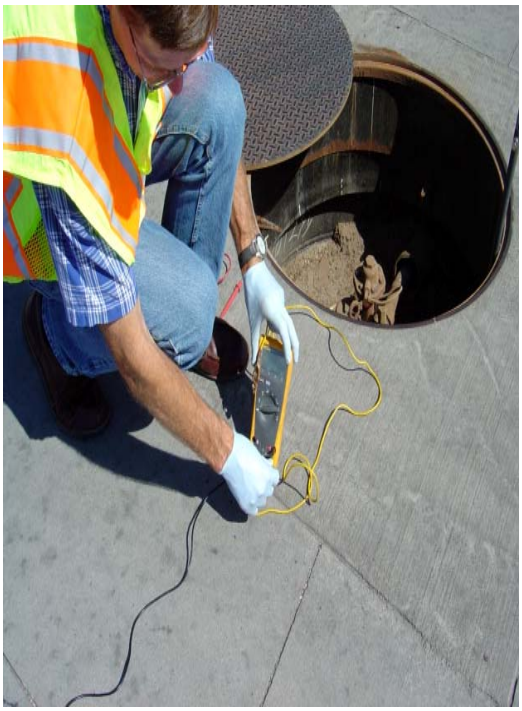


Photo 17

You may have to moisten the backfill with water at the point where the reference electrode makes contact with the backfill if the backfill looks dry or if the millivolt reading on the multimeter is unusually low (Photo 18).

In Photo 19, the inspector is making the metallic connection with the tank at a riser that is not isolated from the tank (i.e., the riser is continuous). If the riser were not continuous, the inspector would use the plumb bob to make contact with the bottom of the tank.

In Photo 19, the reading on the multimeter is less than the -850 mv criterion and close to the native potential of carbon steel. From the results on the rectifier meters (0 amperes and 50 volts), and the low (near native) potential readings over the tanks (~600 mv), further investigation, including testing and repair, is required at this site. A negative polarized potential of at least 850 millivolts (instant off) is required for impressed current system testing or a minimum of 100 millivolts of cathodic polarization. However, in this case we already know we have an inadequately protected steel tank.

Photo 18

Photo 19

After you have taken potential readings over the tanks, check the piping for adequate cathodic protection by placing the reference electrode in the backfill beneath the dispenser and making a metallic connection to the pipe.

Photo 20

Pump Islands and Dispensers

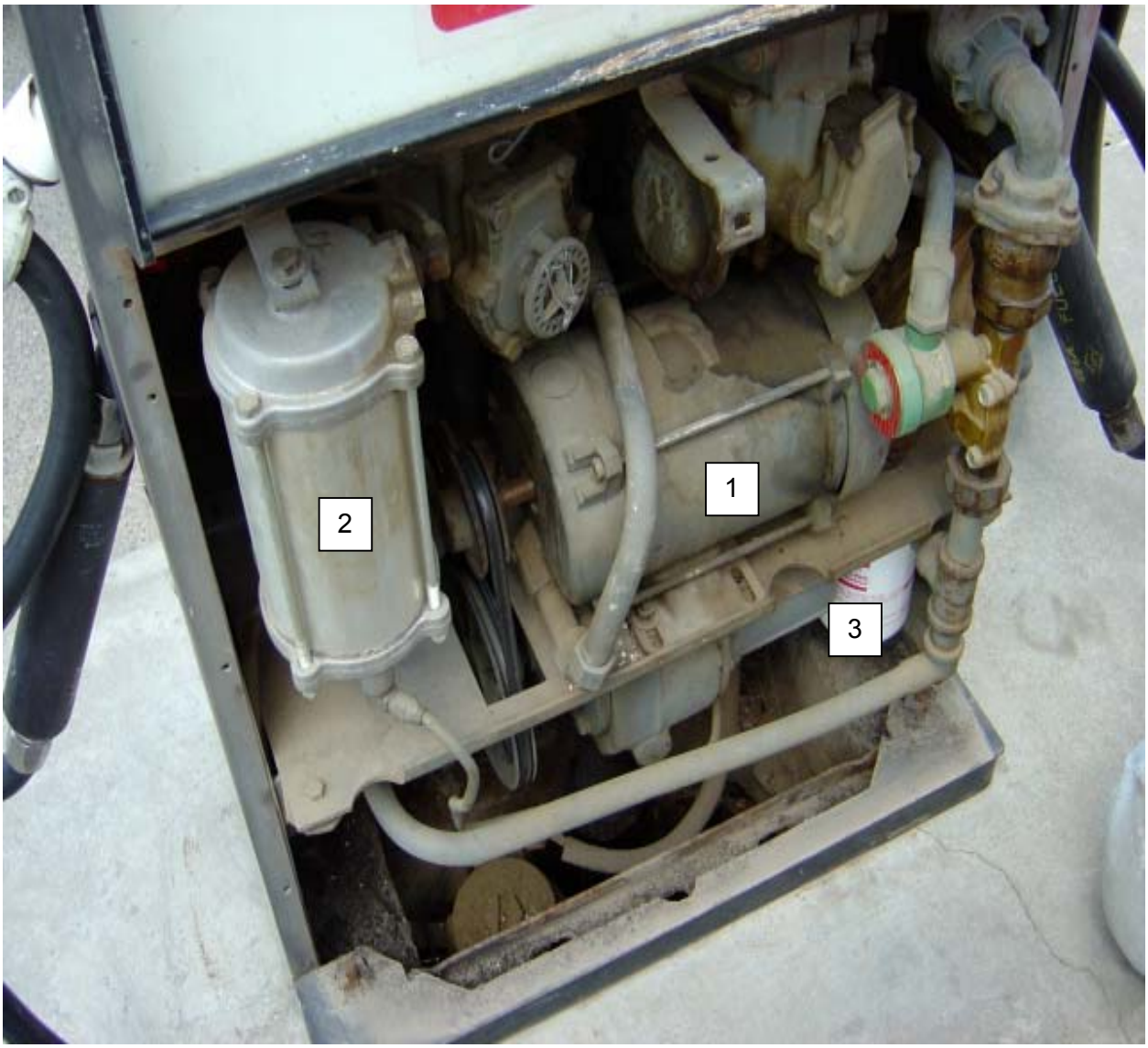
After inspecting the tank field, make sure all covers, bolts, locks, etc. are put back in place and that all equipment is left as you found it. Then inspect the pump islands and dispensers. Open the base of each dispenser. Look for leaks. Also look for dispenser pans (Environ®, Bravo®, Total Containment®). Dispenser pans are required on all new and replacement dispensers installed after August 1, 2007. They can prevent leaks and drips from filter changes from entering the soil below the dispensers. Some of these pans have vapor or liquid sensors wired to the automatic tank gauging (ATG) panel. Look for them. The pressurized system should have shear (impact) valves on each product pipe connected to the dispenser at grade and properly anchored.

If the site uses a suction system, you should be able to see the pump and motor in the dispenser housing. Ask the owner/operator to document if the piping is European or American. Don't just take his word for it. The European system (also called safer suction or union check) does not require line leak detection. The American system (also called angle check) has the check valve at the tank (usually not accessible) and requires line testing every three years. On some installations, a metal rectangular box (usually made by Universal) is located below the union in the dispenser. This box contains the check valve and is designed to simplify valve changes. Its presence should indicate that the system is European. If the owner/operator cannot verify the location of the check valve, you may request documentation from a petroleum service company to verify check valve location.

This may be a poor location for a monitoring well. Notice how the concrete around the well is not built up to avoid infiltration from surface contaminants.

Not only do customers fill their vehicles directly over the cover of the monitoring well, a leak inside the dispenser travels right into the monitoring well (notice the rag around the pipe).

This photo is a suction dispenser, as can be clearly seen by the motor or pump (1), which pulls the product from the tank. The air eliminator (2) removes any air from the lines in a suction system, and the fuel filter (3) prevents any sludge or particles picked up in the lines or tank from entering the customer's gas tank. Always check inside the dispenser to make sure there are no product leaks.



This photo shows the product piping inside the dispenser and beneath the pump or motor with a vertical check valve in place. The check valve beneath the dispenser usually indicates the piping is European or safer suction system. There can also be a check valve inside of the 1-1/2 inch pipe union which is not visible during an inspection. Without a check valve below the pump the system would be a suction system and would require a line tightness test every three years for leak detection monitoring. A suction system has a check valve directly above the tank, which also holds the product in the line when the customer shuts off the pump. Both suction and safer suction piping pull the product up from the tank instead of pushing it (submersible pump). If a breach occurs in the line of a Safer Suction system, very little product is lost because the breach would break the prime and the product would flow back to the tank (provided the piping slopes to the tank). In a suction system, any product in the line above the breach would be released to soil and groundwater.

Concluding the Inspection—Reviewing Records

That should conclude the outside inspection for the tanks and lines. Return to the station office and ask the owner/operator for all required paperwork. This includes, but is not limited to:

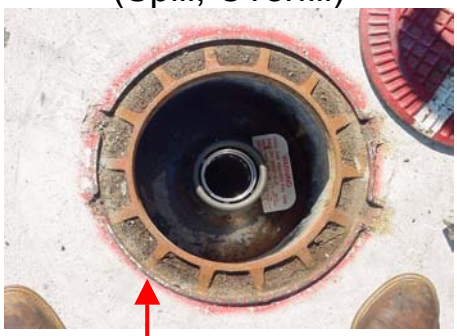
- release detection monitoring (RDM)
- line tightness test results
- cathodic protection test results (if applicable)
- cathodic protection rectifier log (if applicable)
- ALLD tests
- financial assurance (if necessary)
- Repairs, maintenance and calibration

Check the paperwork carefully. The owner/operator is required to keep the latest 12 months of valid leak detection results on site or readily available. Look through the leak test reports if they are organized and immediately available, or ask the owner/operator to organize them for you and submit them within two working days. Review the leak detection records for a valid leak test report for each month (facilities usually test several times a month if not every day). The leak test report should include: test length, product level or starting volume, water level in the tank, and test results (Pass/Fail). Make sure the starting volume is valid according to the third party evaluation. Monitoring results that indicate a “Fail” (unless immediately followed by a “Pass” or due to defective equipment) must be reported.

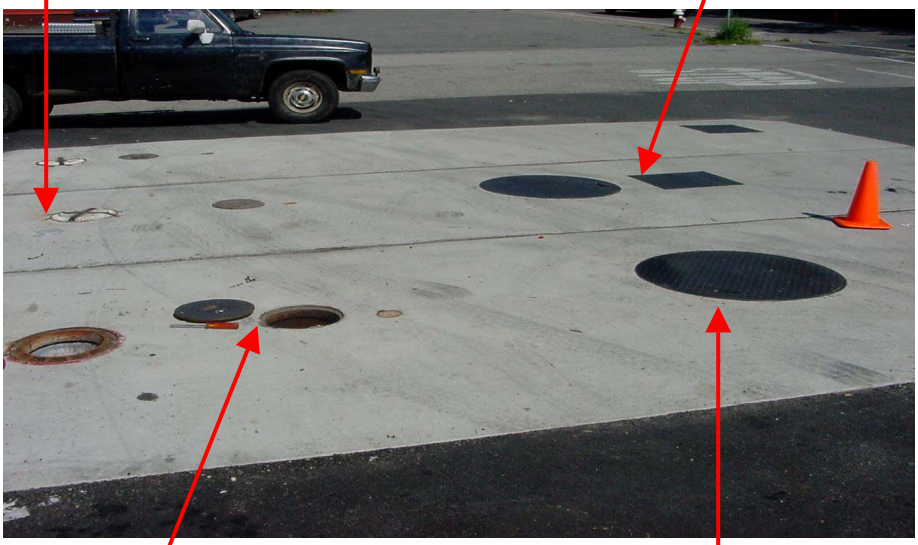
PHOTOS

Looking from the Outside In

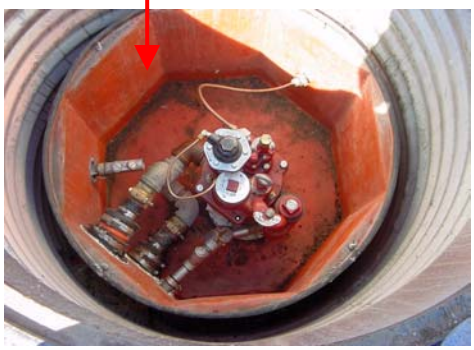
(Spill, Overfill)



(Manifold Systems)



(ATG Access Manway)

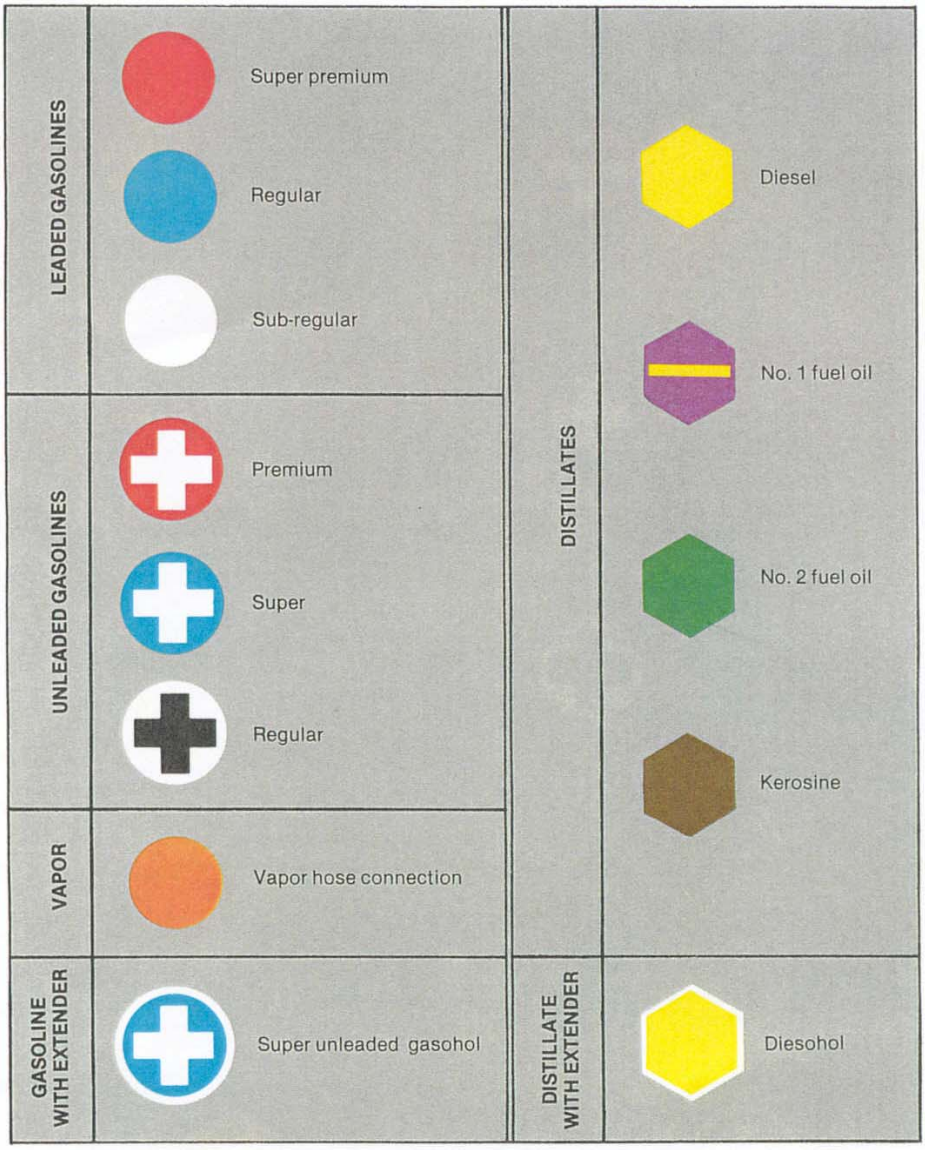


(STP Sumps)

Tank Field Covers

- **Outer covers & API Color Coding**

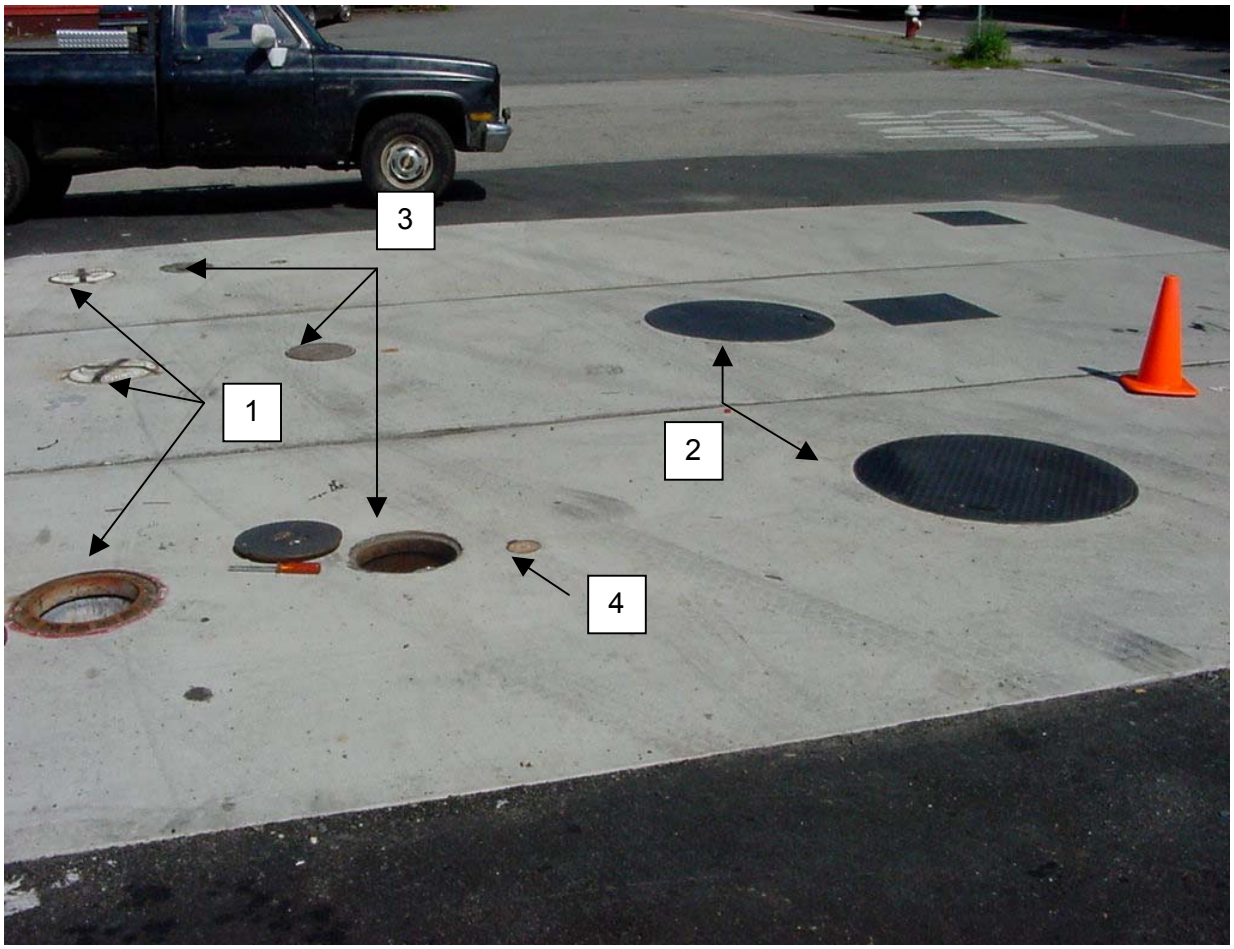
Fill port cover color coding per API recommended practice 1637. All fill ports should be properly coded in accordance with this guide. At many sites you will encounter fill port covers without the cross. The owner or operator is required to properly mark all fill ports if incorrectly marked.



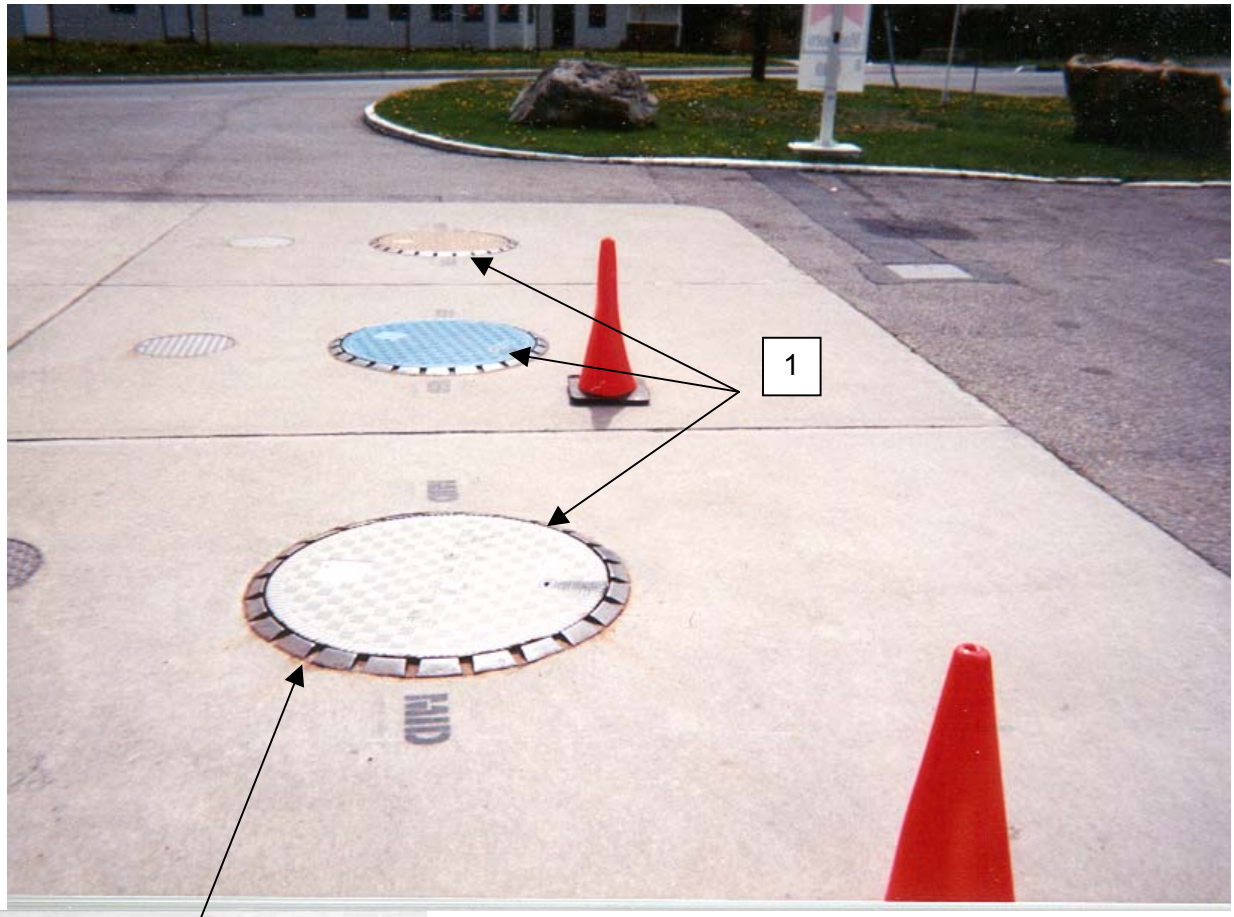
Tank field covers. Three fill ports (1) are present. The two fill ports that are not opened indicate the tanks hold regular grade unleaded gasoline **(see API Marking Requirements in the *General Guidance* section).** The large covers (2) may contain turbine pumps or manways. In this situation, the large covers are located over turbine pumps which indicates the site has a pressurized system for fuel dispensing. The covers (3) are the locations of the in-tank ATG probes. Note: in some cases, the large covers are not turbines, but are manways that are used to access the interiors of the tanks. They are commonly seen at sites which have lined tanks. Item (4) is a cathodic test port for cathodic testing of the sti-P3 USTs at the site.

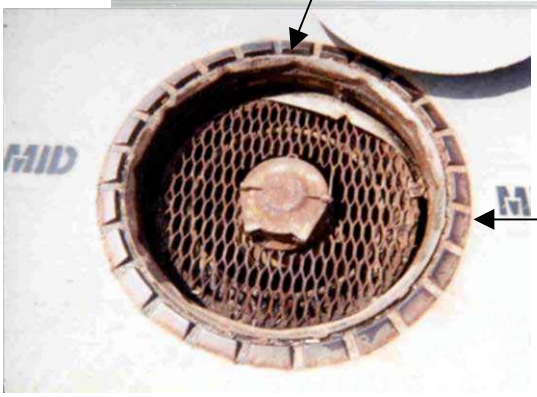
Inspection Significance: There are three tanks as evidenced by the number of fill ports (1), but only two turbine sumps (2), which indicates the two regular USTs are manifolded (i.e., the tanks are connected and one pump delivers product from both tanks). The cathodic test ports indicate a passive or impressed system is present. Make sure you ask for the cathodic test results.

See definitions: ATG, STP, lining, cathodic test port, manway and STP sump, API fill port markings.



These large color-coded covers (Fiberlite®) (1) are actually fill port covers, not turbine sump covers or manways. They are commonly seen at Amoco sites and are marked following Amoco's own internal guidance. The spill buckets which are fitted to the fill port risers are quite large. Inspection Significance: The color codes are not per API guidance which in the near future may be (proposed rule change) non-compliant with IA UST rules and cited as a violation. *See definitions: API, riser, and spill bucket.*





View of the spill bucket and fill port under the mid-grade cover. The grating is to prevent debris from falling into the spill bucket.

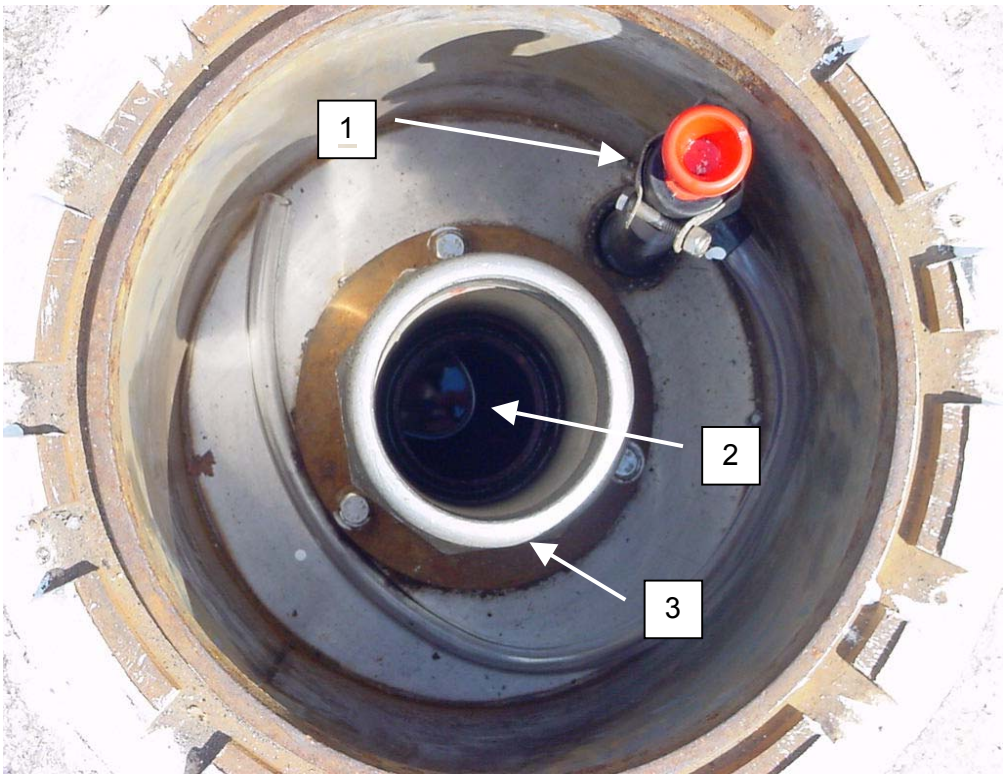
The steel sump cover (1) has been pulled back to show the inner cover (2) commonly used with an STP sump. Inspection Significance: Mark the cover's position relative to the paving with a tire marker or chalk. The cover may only fit in one position. If water is standing on the inner cover, lift one side of it to drain off the water. Try not to get water in the sump because it could trigger a liquid sensor alarm. All covers should be opened and the sumps and equipment contained within inspected to perform a complete compliance inspection. *See definitions: STP sump.*

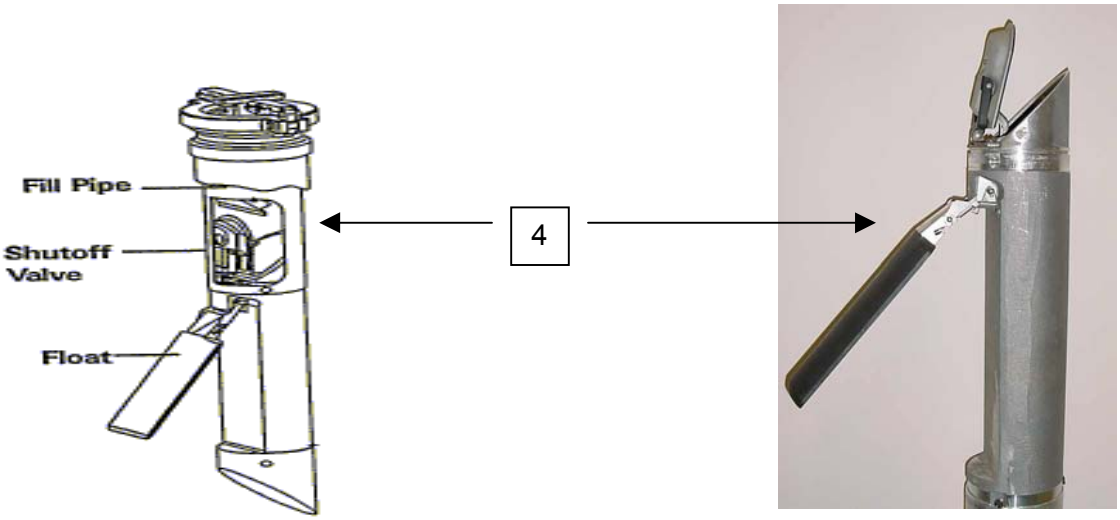
Another type of STP cover. To open this type of cover, you must stand on the cover. Turn the series of six bolts a half turn counter clockwise, then carefully step off of the cover. It will automatically lift itself up. After it is in the raised position, insert the locking latch to lock the cover in the upright position. To close, release the locking latch by pulling on the chain and exerting a little back pressure to push the cover open, then exert a little pressure to push the cover back down; stand on the cover and re-secure the six bolts. No more sore backs!

Spill Prevention

- Spill Buckets

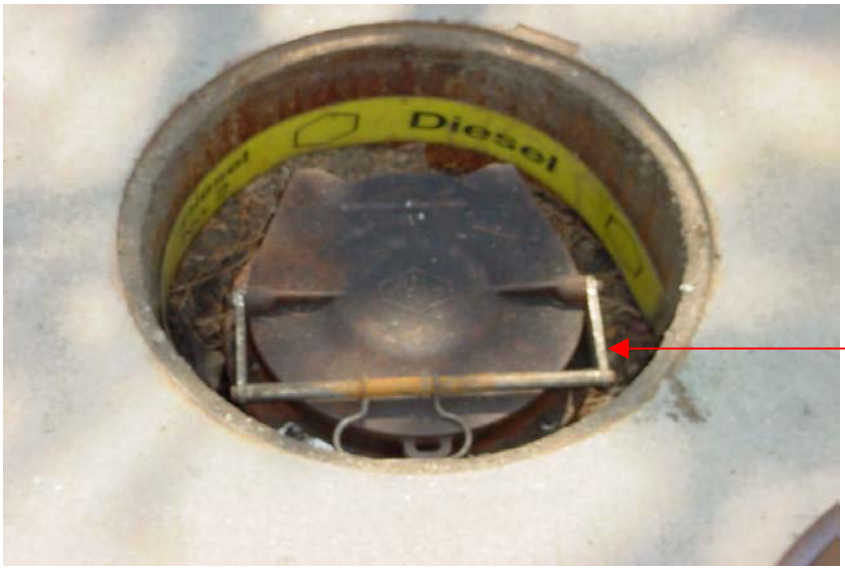
A product-tight spill bucket. A manual pump (1) is used to pump water or product out of the spill bucket. An in-tank float (2) is present in the drop tube (3). The float (2) closes the drop tube when the tank is filled to 95% of its capacity. Item (4) is a diagram and photograph of the in-tank float valve contained within the drop tube. Inspection Significance: This UST is equipped with the required spill prevention (spill bucket) and has a method of overfill prevention (float valve). *See definitions: spill bucket, overfill protection.*

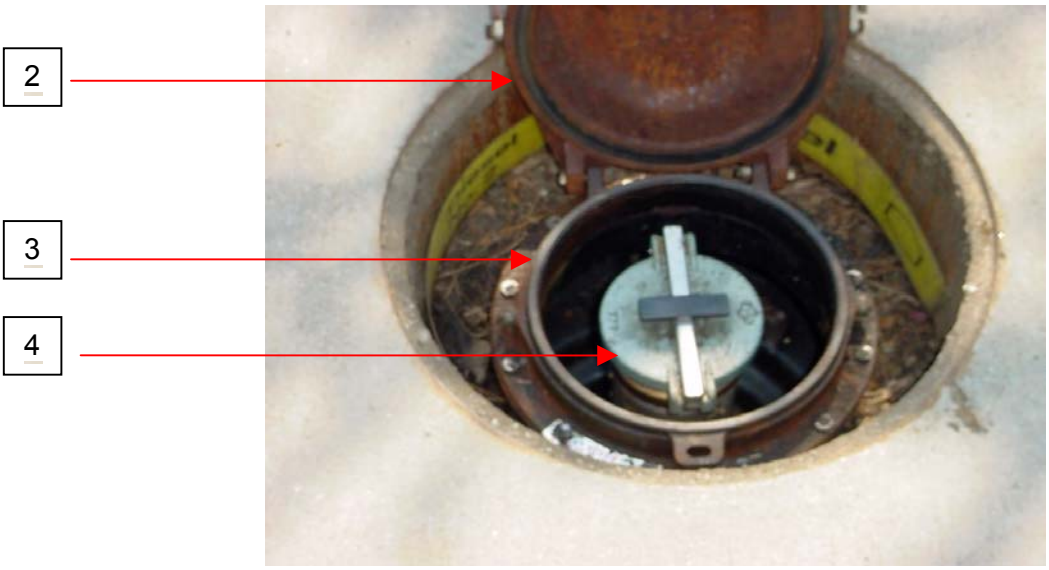




Another type of spill bucket and inner-cover is shown here. The outer, color-coded cover has been removed for the photograph. The cover has a locking bar (1) which ensures that the cover is held securely tight to prevent debris and rain water from entering the spill bucket. A rubber gasket on the inside of the cover (2) helps keep rain water out of the spill bucket (3). Also seen is the cap (4) on the fill port.

Inspection Significance: If debris, water or product is present in the spill bucket, require the owner or operator to remove it. All liquid must be properly containerized and disposed. Look for obvious signs of a lack of integrity such as cracks or a separation of the spill bucket from the fill drop tube. *See definitions: spill bucket, drop tube*.

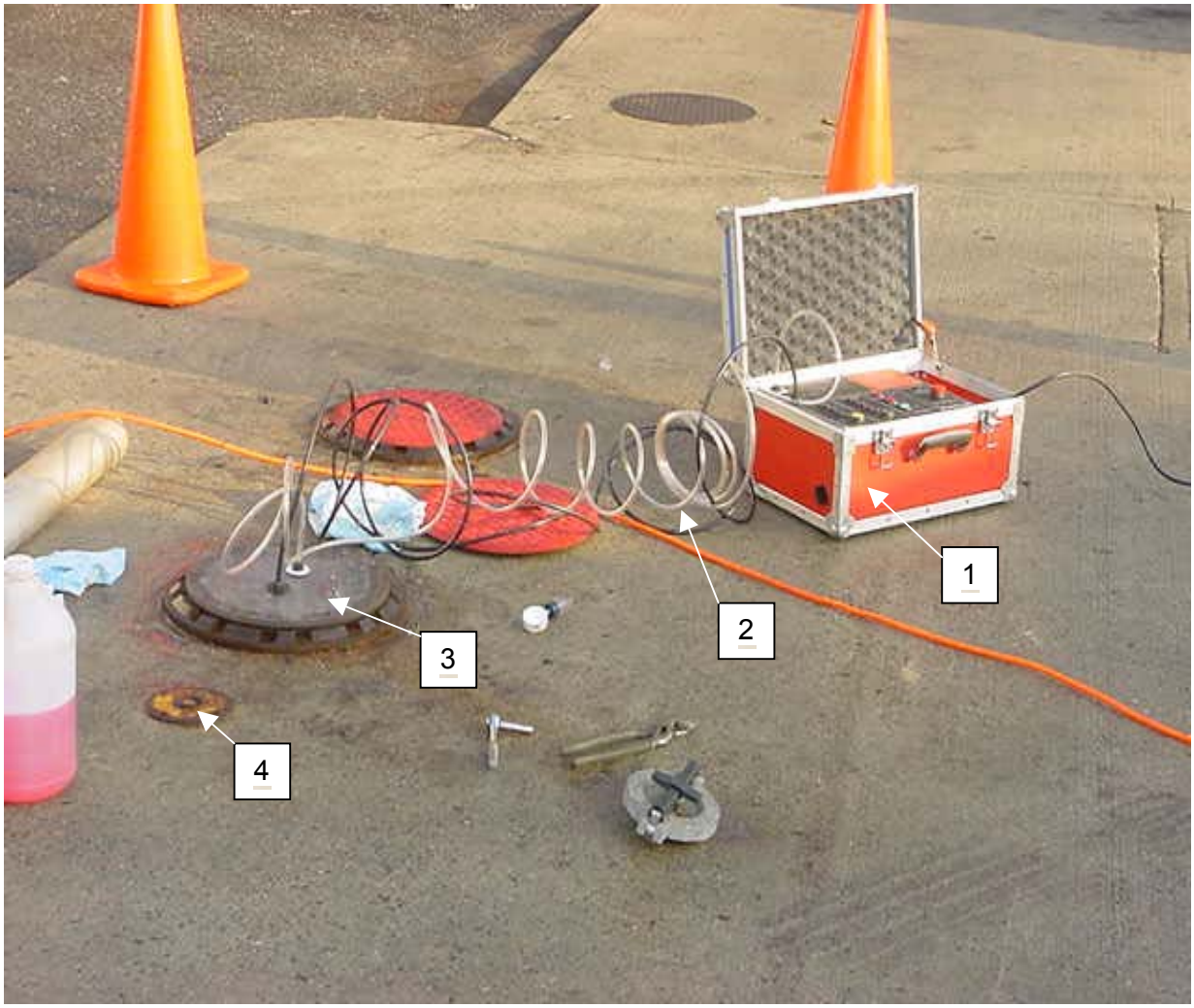




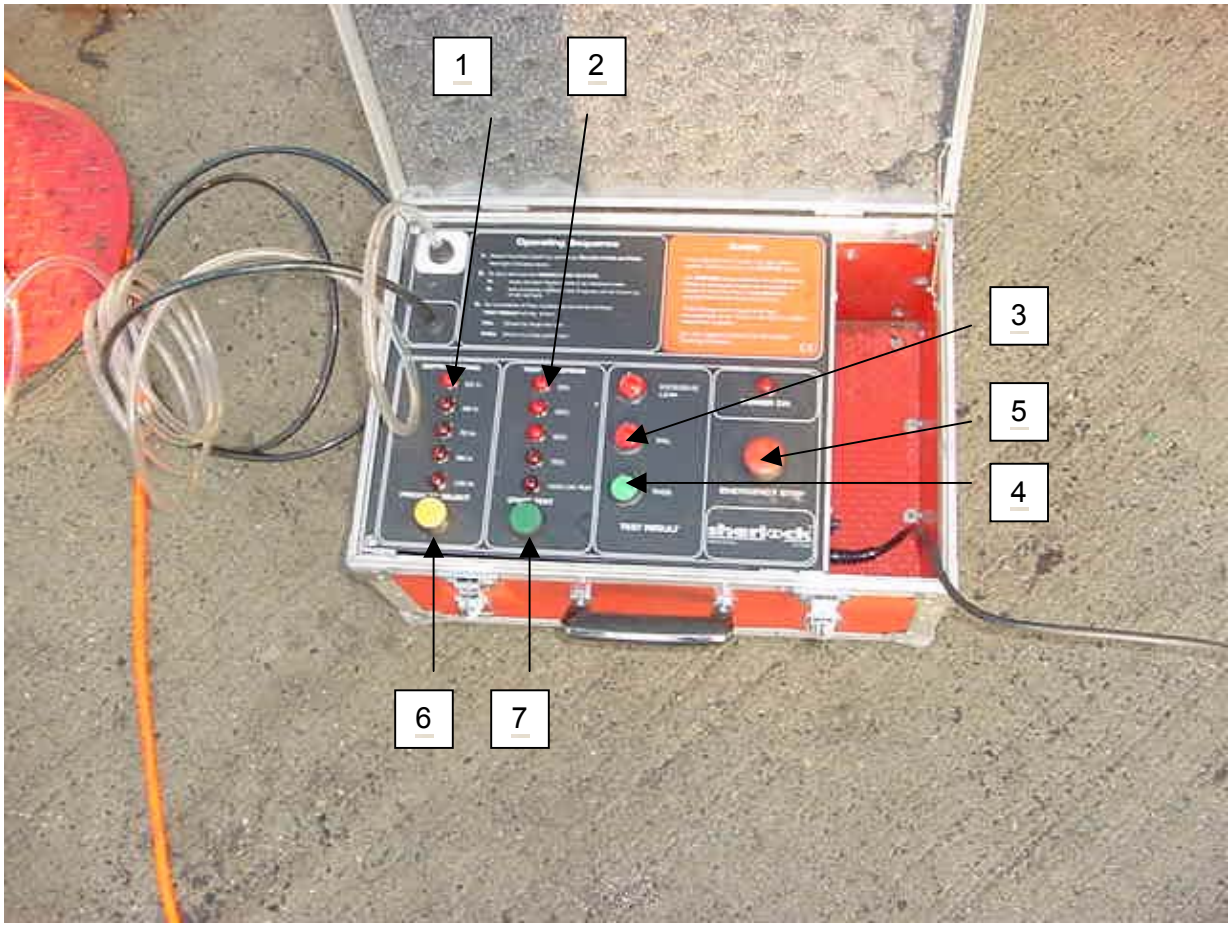
These large spill buckets were commonly found at Amoco sites. The steel grating is to prevent debris from entering the spill bucket. Inspection Significance: If debris, water or product is present in the spill bucket, require the owner or operator to remove it. Look for obvious signs of a lack of integrity such as cracks or a separation of the spill bucket from the fill drop tube.
See definition: spill bucket.

This device (Sherlock®) generates a vacuum which is used to test spill buckets and STP sumps. The control panel and vacuum pump (1) are attached by hoses (2) to the Lexan® cover which is sealed with a gasket on the spill bucket rim (3) of an incorrectly color-coded premium tank (the cover is missing the required white cross). This test can be used on spill buckets (as shown here) and some STP sumps with product-tight chambers. This test is not required in the UST rules, but is frequently used to determine the integrity of spill buckets and STP sumps. Also of note is the cathodic test port (4).

See definitions: spill bucket, Sherlock® . and cathodic test port.

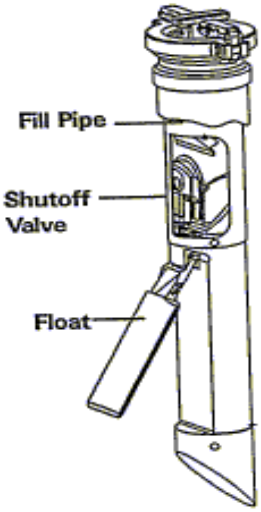


A close-up view of the Sherlock®. control panel. The amount of vacuum (inches of water) is shown by the status lights (1). The percentage (0-100%) of vacuum drawn is indicated by the status lights (2). The power button (6) and the test button (7) are also shown. The fail light (3) comes on if the vacuum cannot be maintained and the pass light (4) indicates a successful test. The vacuum purge and reset button is labeled (5).
S*ee definitions: spill bucket and Sherlock®*



Overfill Prevention

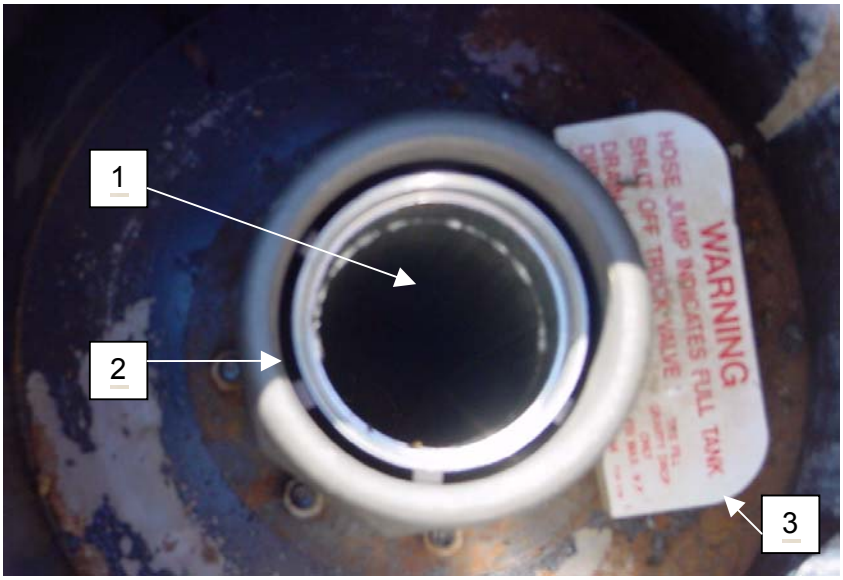
- 90% flow restrictor
- Overfill alarm
- In-tank float valve

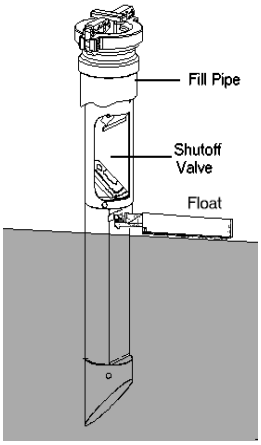


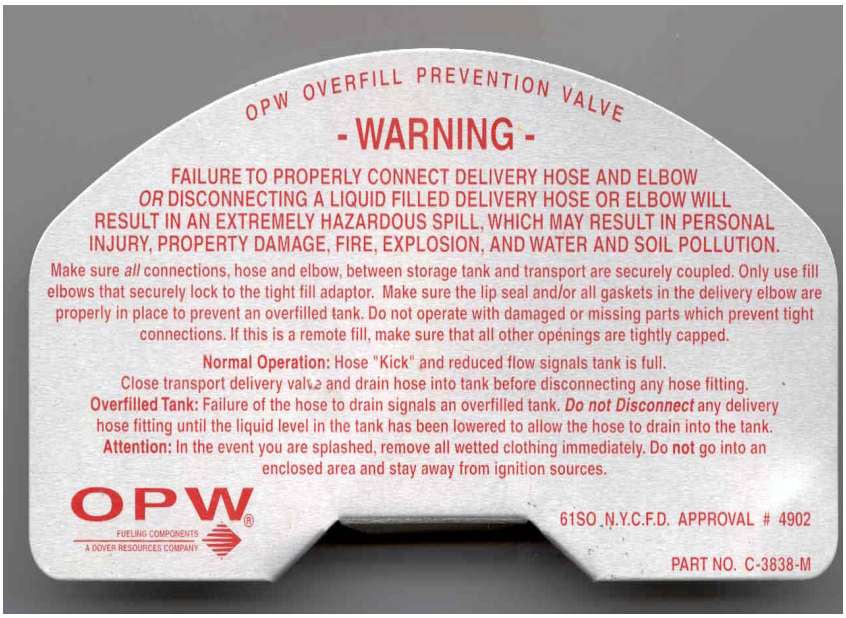
Ball Float
Float Valve

Overfill ball float commonly referred to as a 90% flow restrictor. This device is located in the UST and is connected to the vent line which is located just above the top of the UST. As product is introduced into the UST and it reaches the ball (1) at the bottom of the device, the ball floats on top of the product. When the ball reaches the end of the extension (sub) (2), it restricts the air flow out of the UST through the vent line. At this point, the UST is 90% full. This restriction causes a significant slowdown of product delivery into the UST signaling to the delivery person to shut off the valves on the delivery truck to avoid an overfill. Because the UST is only 90% full, this allows the product remaining in the delivery hose to drain into the UST without overfilling the tank. The cap (3) is typically what is seen under a small cover at the tank field for this type of overfill protection. Inspection Significance: This type of overfill protection should not be used for suction systems, systems with remote fills or systems that receive deliveries under pressure. Since the ball and sub are located within the tank, the cap (3) must be located along the center line of the tank to indicate the presence of a 90% flow restrictor. Ball Float valve assemblies must be suited to the tanks size. Obviously a 20,000 gallon UST will need a longer ball float valve than a 5,000 gallon UST in order to restrict flow at 90%. *See definitions: Overfill prevention.*

This is a coaxial drop tube that also includes a method of overfill protection as well as being one of two methods of Stage I vapor recovery (NA in Iowa). The inner pipe (1) conducts fuel from the tanker to the UST. The vapors return to the truck through the space between the inner and outer pipe (2). The warning labels (3) indicate the coaxial is made by OPW and also contains an in-tank float valve that prevents over filling the tank. As product fills the UST, the float rises and closes the shut off valve, severely restricting flow of product into the UST. Item (4) is a photograph of the in-tank float valve contained within the drop tube. Inspection Significance: Verify the presence of the float valve by looking down the drop tube with an intrinsically safe flashlight. The presence of the coaxial drop tube and the warning label do not guarantee that an in-tank float (overfill protection) is present. If no float is present, verify what method of overfill is used for the UST. *See definitions: Stage I, co-axial and overfill protection.*

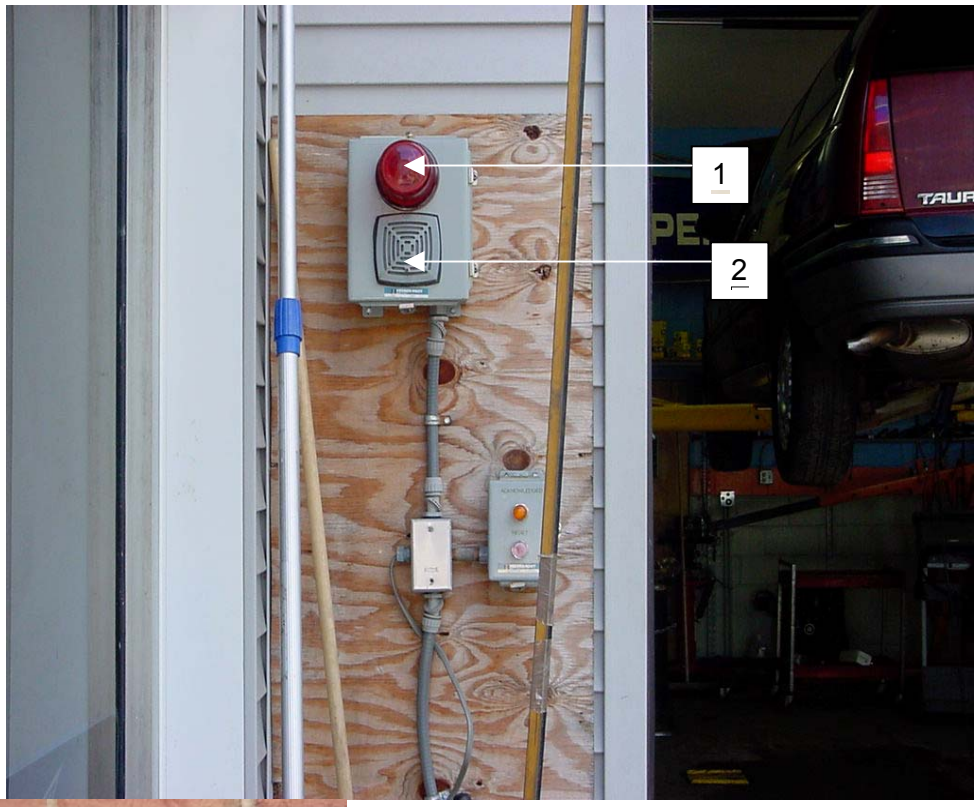




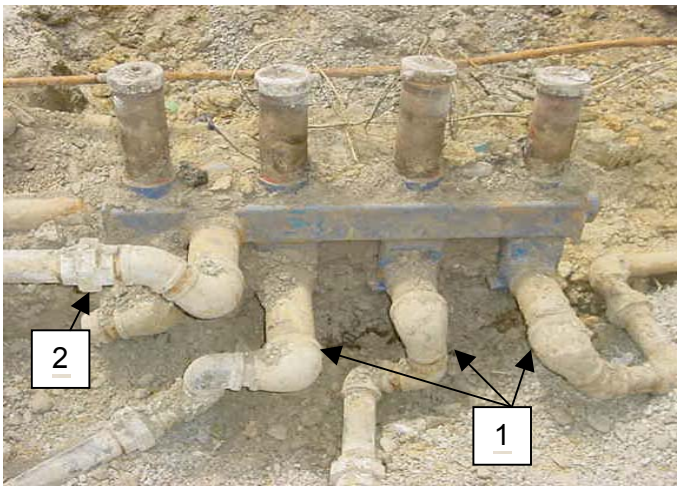


3

This unit, which should be located outside the building and near the tank field, contains a red light (1) and a horn (2). The unit is connected to the ATG panel and should give a visual and audible warning when the UST is filled to 95% of its capacity. The bell (3) in the inset photograph is another form of an alarm that can be used for overfill compliance.
Inspection significance: An alarm must be located in view or hearing of the delivery driver to serve as a warning to prevent overfill of the UST. If this is the method that the owner or operator is using for overfill protection, it must be located within view of the driver. If it is not within sight or hearing of the tank field, the owner or operator should be cited for a lack of overfill protection.
See definitions: ATG and overfill prevention.



This is a Fairfield or Sunoco box which contains threaded caps (1) for the ball floats. Sometimes these caps are color coded for the product of each tank. Since the ball floats in a Fairfield box are outside the tanks, the tank is already overfilled by the time the float blocks the vent pipes. A Fairfield box does not meet the requirements for overfill protection. Inspection Significance: Document what type of overfill protection the site uses. A Fairfield box is not overfill protection. *See definitions: Fairfield box, ball floats and overfill protection.*



The same Fairfield box excavated one month later. The three lower lines (1) are the vent lines from the three USTs located on site. Line (2) is the vent line from a stage 2 vapor recovery drop tank.

Vent Pipes

Vent pipes for the USTs. Inspection Significance: When doing an inspection, always look for the vent pipes and check if the number of vents corresponds to the number of tanks. Vents can be manifolded. If there are more vents than registered tanks, suspect the presence of additional tanks, possibly unregistered. They also may be from a former tank(s) that has been closed. Verify the situation with the owner/operator. *See definitions: Vent pipes.*

There are two vent pipes in this picture. The short one on the right (1) was typical of a vent for a waste oil or heating oil UST. Inspection Significance: neither of these vent pipes is acceptable or legal. All vent pipes for Class I fuels must discharge in an upward direction in order to disperse vapors and terminate at a minimum of 12 feet above grade (NFPA 30, 3.7.2.1). (2) is an unknown. You should document its presence and ask the owner or operator to explain its purpose. Suspect another UST, likely an unregistered waste oil UST, if your pre-inspection database check does not show as many USTs as there are vent pipes. *See definitions: Vent pipes.*

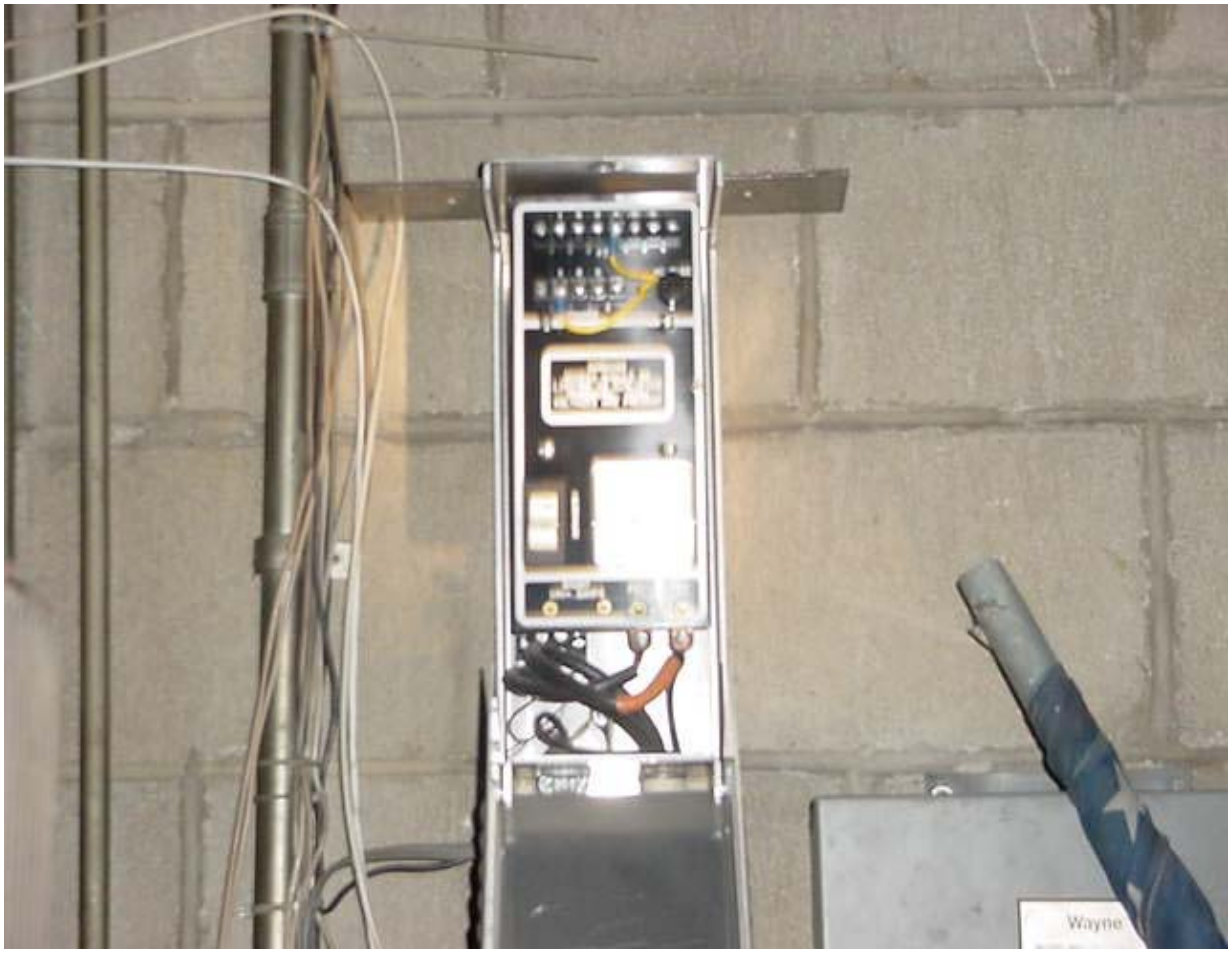
Corrosion Protection

- sti-P3® Tanks
- Rectifiers
- Cathodic test ports
- Ranging volt meter

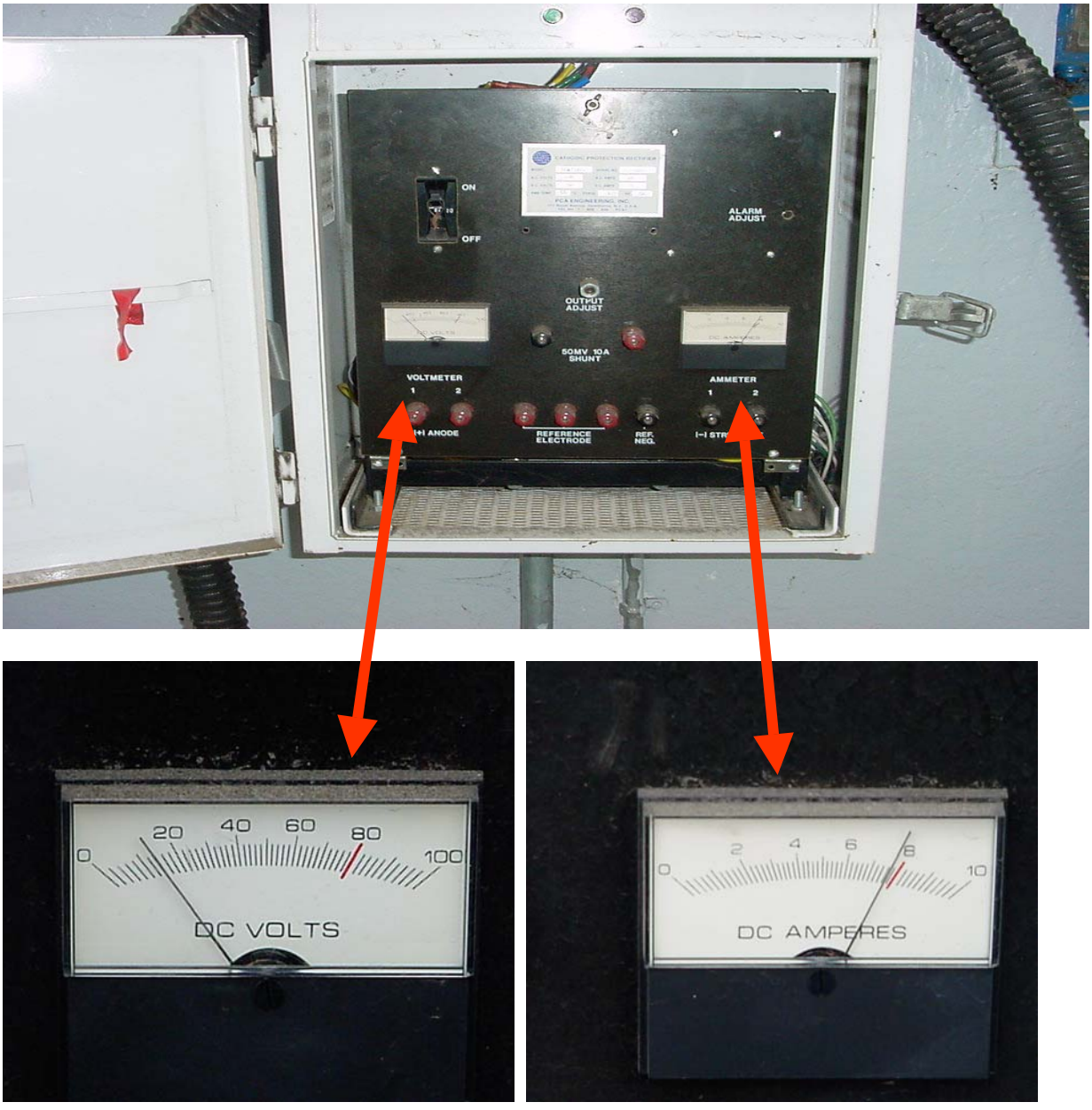
An sti-P3 tank (sti = Steel Tank Institute). All sti-P3 tanks of 10,000 gallons or less are shipped with anodes (1) attached to each end. The anodes, in part, protect the tank from corrosion. In addition, the 2-inch riser (2) indicates this UST is double-wall and the riser is connected to the interstitial space. The riser provides an access point for monitoring of the interstitial space by either electronic sensors or by manual checks. Not as apparent are the two additional methods of corrosion protection which are the outer coating and the dielectric bushings (3) where the system piping will be connected to the UST. When the UST is installed, a cathodic protection test port with a test wire should be installed at ground surface to be able to conduct a corrosion test of the UST every 3 years. *See definitions: dielectric, sti-P3, interstitial, cathodic test port.*

A rectifier for an impressed cathodic system. The rectifier converts alternating current (AC) to direct current (DC) which, through buried wires and anodes, is introduced to the soil around the tank field and/or product lines. This current protects the steel tanks and lines from corrosion. Please refer to the section concerning cathodic testing.
Inspection Significance: Open the cover and determine if the system is running. Ask the owner or operator to verify that the rectifier is operating, and to present documentation that its operation has been checked every 60 days.
See definitions: impressed system, corrosion and rectifier.

The cover on this rectifier has been opened for inspection. Be careful when opening a panel because 120 volt lines are present. The unit should be opened to confirm that it is turned on. This can be verified by an illuminated pilot light or readings above zero on the gauges (if present). Inspection Significance: The panel must be inspected and verified that it is operating by the owner or operator every 60 days. In addition, the system (cathodes and wiring) is required to be tested every three years (a cathodic test). The owner or operator should have records of the 60-day check as well as the results of the three-year cathodic test. Please refer to the section concerning cathodic testing.
See definitions: impressed system, corrosion and rectifier.

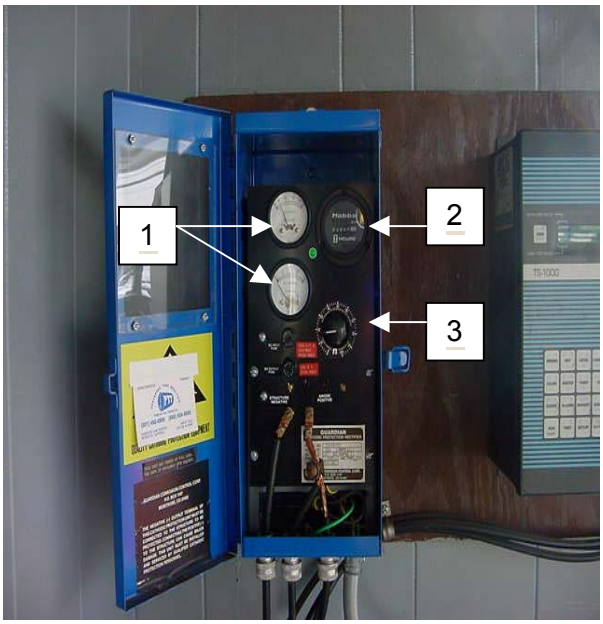


Another manufacturer's rectifier. This unit has both an ammeter and a voltmeter. The gauge readings indicate whether the rectifier is operating. Inspection Significance: Record meter readings on your checklist. You must require that the owner or operator verify the 60-day panel inspection status and the required three-year cathodic test results. If qualified, you may take potential measurements over the tanks using Instant Off or 100-millivolt shift criteria. Make sure the rectifier is turned on when you leave after turning it off for Instant Off measurements. *See definitions: impressed system, corrosion and rectifier.*

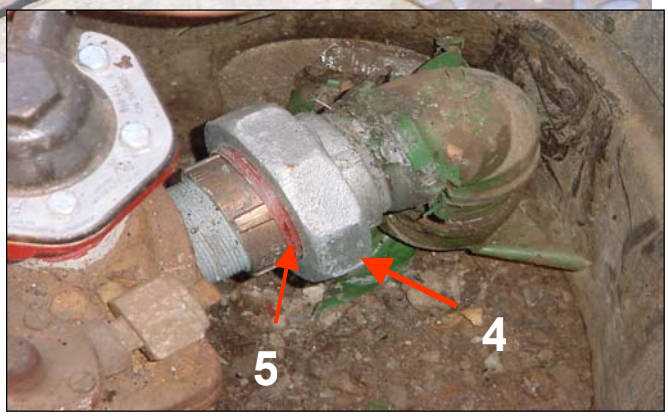


This rectifier contains both an ammeter and voltmeter. To verify that the rectifier panel is on, these gauges should have values above zero. The readings do not tell you that the system is protecting the tanks and lines; it only indicates that the unit is operating.
See definitions: impressed system, corrosion and rectifier.

Another example of a rectifier which has both ammeter & voltmeter (1) which show positive values. Also present is an hour meter (2) which shows the total hours this panel has been operational. In addition, this unit has a rheostat (3) that is used to change the voltage settings. Do not alter the setting. Inspection Significance: Although the system at this station seemed to be functioning, the purpose of the rectifier could not be explained because all tanks and lines were constructed of fiberglass. The owner or operator was uncertain why the unit was present. Be aware that such conflicts in equipment present at a facility can and will occur. It was later determined that when the old steel lines were replaced with fiberglass, the rectifier was never removed of even turned off! The bottom line? Is the facility in compliance? *See definitions: impressed system, corrosion and rectifier.*



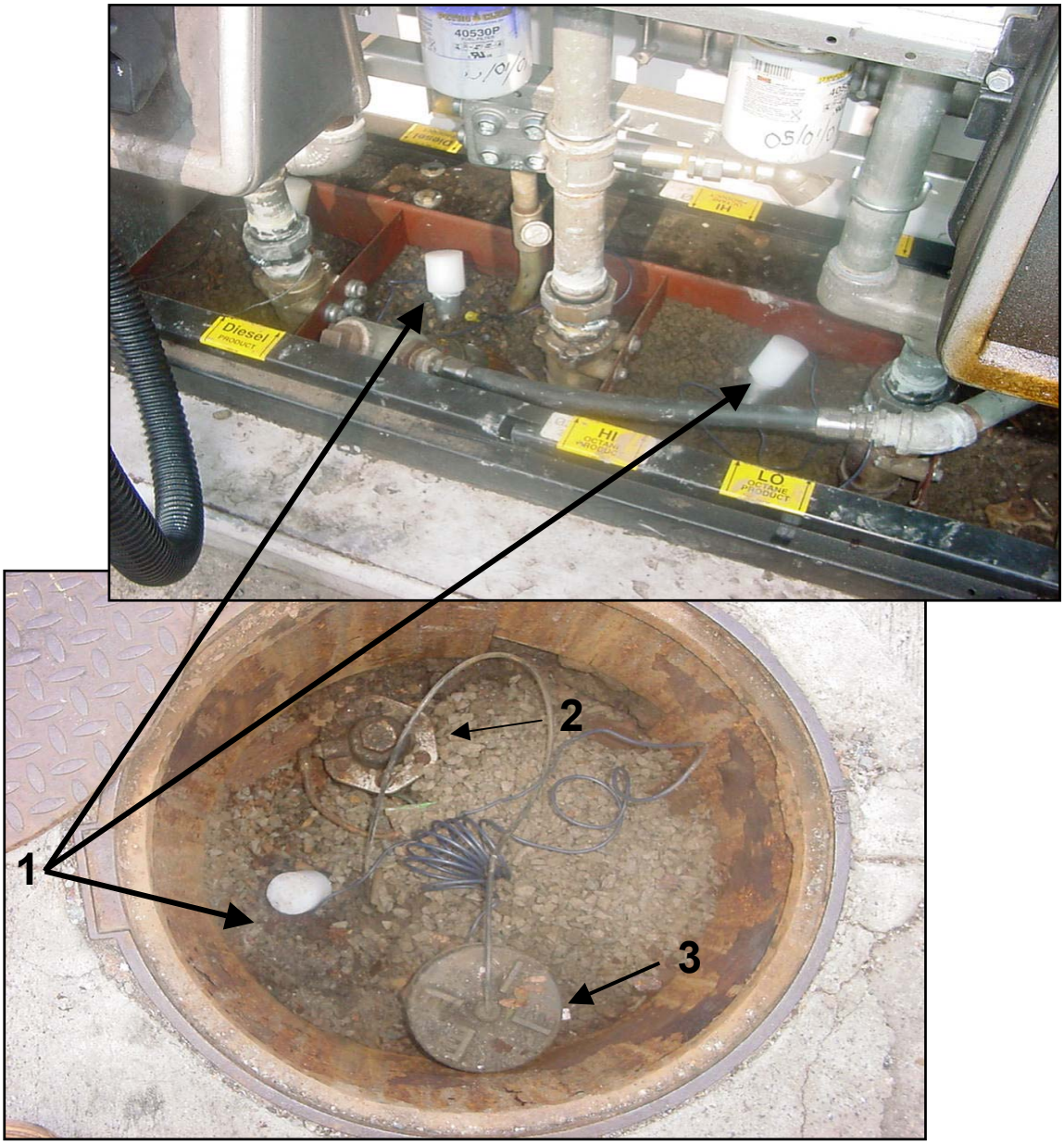
This STP sump does not have a product tight chamber. The line (1) is a wire lead from an impressed current cathodic protection system. The piping at this facility is bare steel and thus must be protected from corrosion. The lead from the rectifier (1) is clamped to the piping at location (2) as well as other locations along the lines not pictured here. Multiple CP test stations like the one shown in the inset photograph (3) were found through out the site to enable a check of the corrosion protection system. Item (4) is a dielectric union which electrically isolates the piping from the turbine and tank so that the CP system only works to protect the product piping. They can also be found at the dispenser end of the product piping. Without a dielectric union the CP system works to protect from corrosion all metal connected to the piping including electrical conduit, the turbine, etc. Item (5), the red ring, is the plastic gasket inside of the union that electrically isolates the 2 halves of the union. Inspection Significance: Just because a corrosion protection system is present, do not assume it is protecting the UST system. An UST system is considered to be adequately protected from corrosion if the negative potential is negative 850 mv or greater (NACE criteria). In this case a reading of only -713 mv was measured, indicating the piping was not adequately protected.



An attempt at corrosion protection! Item (1) is a sacrificial or galvanic anode that has been placed in the STP sump and connected by a wire lead to the bare steel piping not visible in the photograph. The negative potential readings were around one half the recommended -850 millivolts-- suggesting (as if you had to measure to figure this one out) the anode is not protecting the lines.
Inspection Significance: Anodes must be installed in the proper backfill with the packaging removed! Cathodic protection cannot occur here as the anode is not installed within the electrolyte (soil) with its proper backfill. Hence, current cannot flow from the anode to the cathode to protect it. If you come across something like this, require the owner to get a certified cathodic protection tester to make repairs. Furthermore, this is an example of when you think you have seen it all, you haven't.

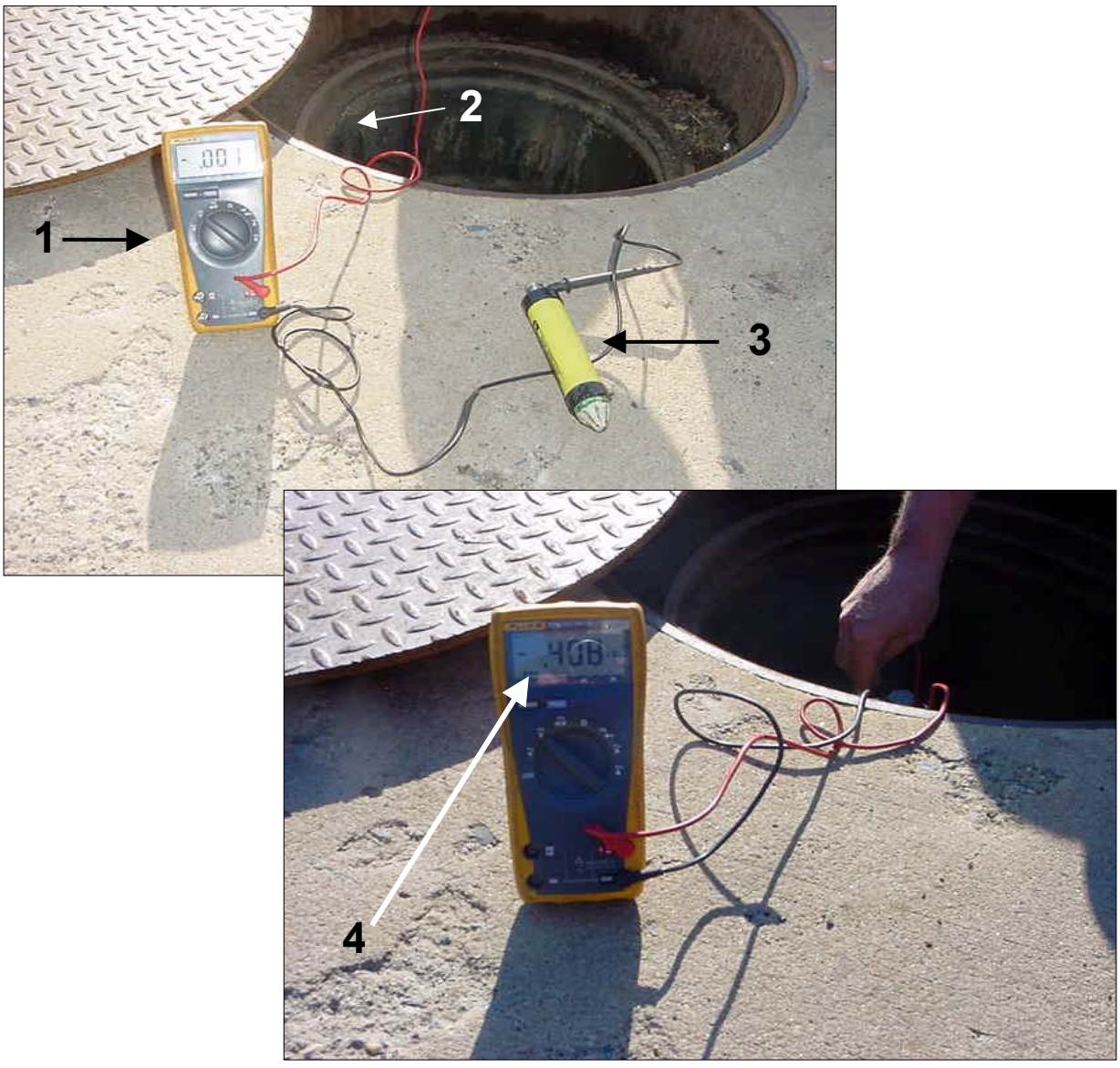
This is a bracelet anode attached to the piping below the dispenser. Either some serious erosion occurred at this site or it is expecting a sudden and significant sedimentation event. The only way to protect the piping with this anode without moving it would be to flood the area so the anode and the piping it's attached to are in the same backfill or electrolyte. The anode should have been buried (i.e., in contact with the electrolyte) in order to protect the piping or flex connector. This photo is not unlike the anode bags installers neglect to remove from sti-P_3 tanks or the previous photo where the anode is tossed into the sump. Once again, there is no current flow from the anode to the structure being protected unless the anode is placed in the proper backfill. A spike anode would have been a better choice. *Photo courtesy of PMMIC*

The following are referred to as spike anodes (1). These anodes are driven into the soil and connected by wire and clamp to the piping for corrosion protection. The upper photograph shows the anodes at the dispenser end of the piping and the lower photograph shows the anode at the STP sump at the same facility. Item (2) is the top of the LLD. The remainder of the turbine and piping is buried in soil and is not visible for inspection or routine maintenance. Item (3) is an ATG probe for tank monitoring. Inspection Significance: This type of corrosion protection is acceptable; however, documentation pertaining to their installation and the required 3 year test must be available. As with any anode these items have a finite life time and must be replaced as required. *See definitions: STP, LLD.*



Two types of cathodic test ports, usually found in the tank field, should be painted yellow for identification purposes only: it is not a regulatory requirement. It can also be identified by “CP Test” and the five-side bolt. The cap (1) is opened by turning the cover one-half revolution. Under the cover are wires (usually 14-gauge) attached to screw terminals (2). These wires are attached to the tanks (especially sti-P_3) because the tanks are electrically isolated from the risers and piping by dielectric bushings. These wires may also be attached to product piping. A ranging voltmeter is connected to each wire to perform a cathodic test. *See definitions: impressed system, corrosion, dielectric bushing,* sti-P_3 *and rectifier.*

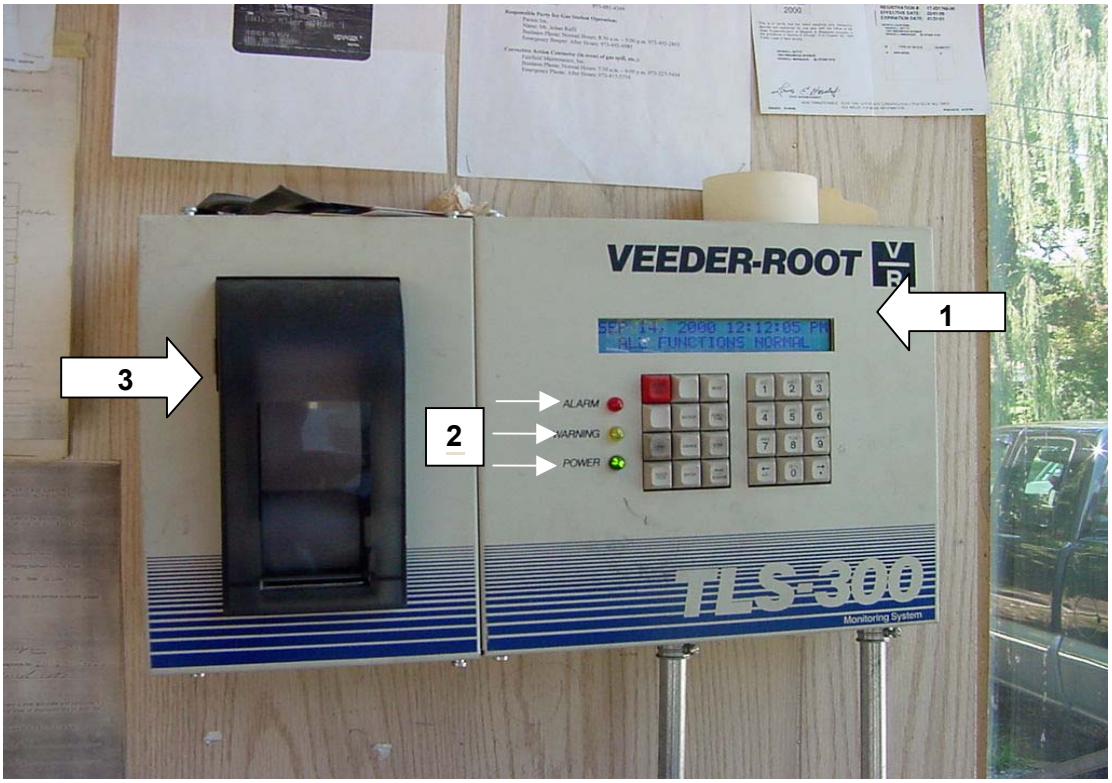
A multimeter (1) is used to test UST systems for corrosion potential. During a test of the system, the red lead (2) is connected to the UST or piping. The reference cell (3) is then placed in contact with the backfill adjacent to the UST system. The ranging voltmeter displays the negative potential in millivolts-DC (4). An UST system is considered to be adequately protected from corrosion if the negative potential is - 0.85 or greater (NACE criteria). In this case a reading of only -.408 was measured indicating the UST was not adequately protected. Inspection Significance: Require that the owner or operator have a certified corrosion tester confirm any readings and, if necessary, perform all repairs or upgrades to the corrosion-protection system.



ATG Systems and Operation

- Veeder-Root
- EMC
- Marley Pump
- Wilco
- EECO
- Petrosonic
- Auto Stik
- Incon
- Pollulert
- Site Sentinel
- Soil Sentry

A typical automatic tank gauging (ATG) control panel. Veeder-Root ATGs are the most common systems you will see during inspections. Some common models include the TLS-200, 200i, 250, 300, 350, 350 CSLD and Simplicity. These units monitor minute changes of the product levels in the tanks and can be programmed to do daily, weekly and monthly tank tests. If the station is using an ATG unit for leak detection, make sure the unit is third-party certified or evaluated to test the tanks at a maximum leak rate of .2 gph. (A copy of the third party leak detection evaluations can be obtained on line at www.nwglde.org). The ATG can also monitor the lines through various sensors and related equipment. The interstitial space (lines and tanks) can also be monitored. If the unit is operating properly, the liquid crystal display (LCD) (1) should have a message that reads "ALL FUNCTIONS NORMAL". Check to see if the power light (2) is on. Warning and alarm lights are also located on the panel at (2). If either of these lights is illuminated, a corresponding message will be present on the LCD. The printer (3) (not always present) may be used to print out test results and inventory checks. Inspection Significance: You should verify that the equipment used to conduct leak detection is present and operating, i.e., sensors and probes. Just because there is an ATG unit present, don't assume that leak detection is being conducted properly. Review leak test reports to make sure they are valid (minimum product test level). The system can also be used for overfill protection. You will need to confirm this. If you are not certain about the operation of the unit, have the owner or operator document what the unit is monitoring and if the monitoring is done per the regulations. The owner or operator must be able to verify that the unit is performing a tank test at least every 30 days.
See definitions: ATG, liquid sensor, tank probe, pressure transducer, CPT, overfill prevention and interstitial (ATG = another tank gone).

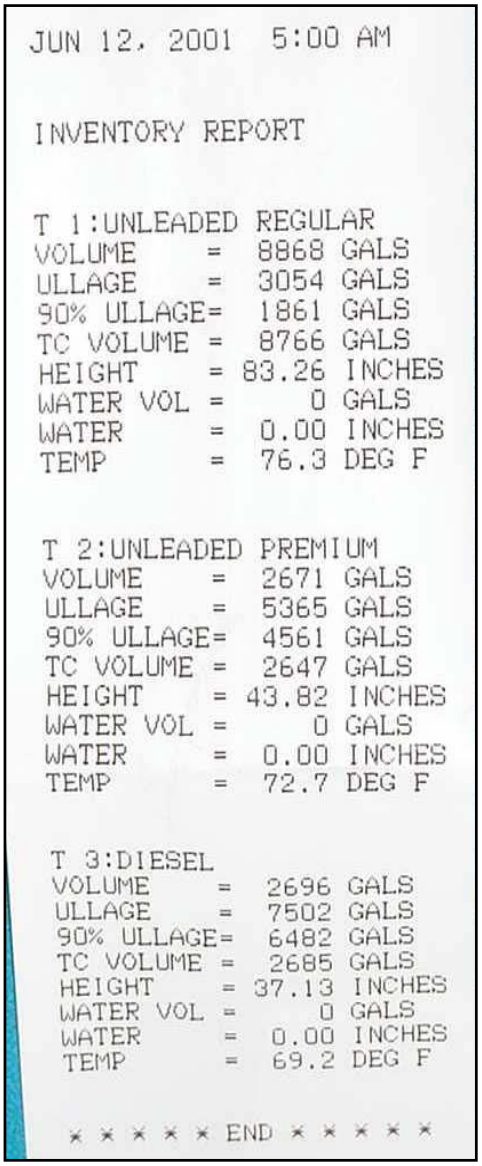


Veeder-Root also manufactures the Simplicity® system (now replaced by FMS or Fuel Management Services) which is usually found at Exxon/Mobil sites. These units usually do not have a printer and are monitored at a remote location. Inspection Significance: In many cases, the owner or operator will not have leak detection records present. You may require that the owner or operator contact the monitoring company (using the site ID number) and have these records forwarded to you. Typically, the Simplicity® unit also monitors the lines using a pressure transducer (PLLD). *See definitions: ATG, liquid sensor, tank probe, pressure transducer, PLLD, CPT, overfill, Swiftcheck, Simplicity and interstitial.*

The Auto-Stik is another type of ATG unit which is manufactured by EBW, manufacturers of sumps, overfill equipment and spill buckets. This unit has a printer (1) as well as a liquid crystal display message panel (2). Inspection Significance: Don't assume the unit is doing leak detection. The owner or operator is required to furnish documentation that tank tests are being performed monthly and that the unit is operating per the manufacturer's requirements. *See definitions: ATG.*

This INCON unit has a printer (1) as well as a liquid crystal display message panel (2). Inspection Significance: Don't assume the unit is doing leak detection. The owner or operator is required to furnish documentation that tank tests are being performed monthly and that the unit is operating per the manufacturer's requirements. *See definitions: ATG.*

These are two examples of typical ATG panel print-out tapes from different sites. They show an "Inventory Report" and a "System Status Report". Take note of the status report on the right-hand sample. The status report identifies that tank T1 has a "Low Product Alarm" as well as a "Delivery Needed" message. More importantly, the ATG panel indicates a "Leak Alarm" and "Sudden Loss Alarm" for tank T2. Inspection Significance: Always observe the ATG panel during the inspection to verify the current system status. The owner or operator must be required to conduct an investigation to verify the alarm status and/or to determine whether a discharge has occurred if the ATG displays a message like the one shown here.



JUN 12, 2001 5:00 AM

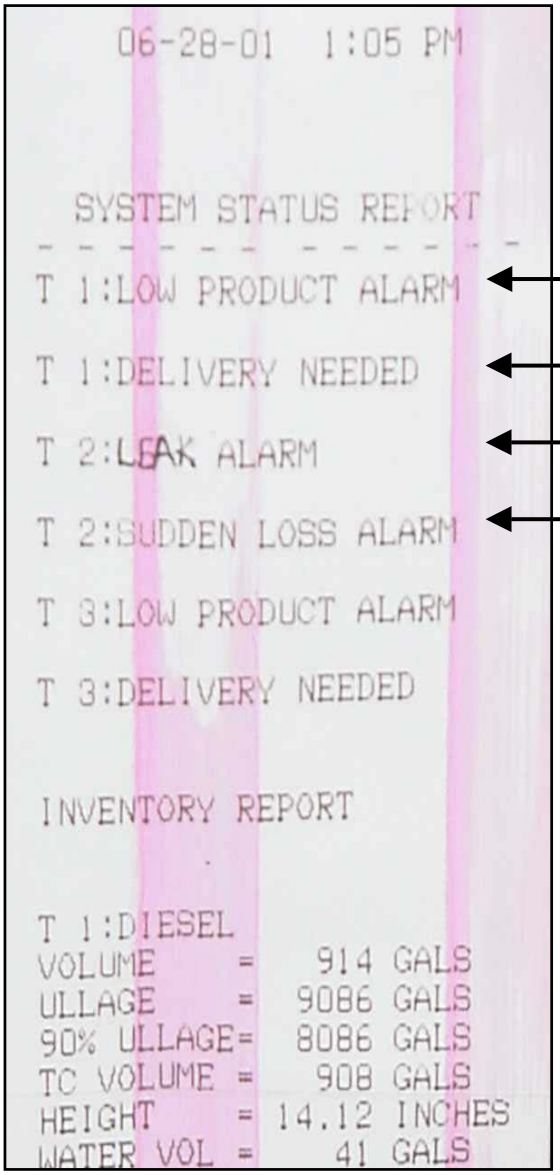
INVENTORY REPORT

T 1:UNLEADED REGULAR
VOLUME = 8868 GALS
ULLAGE = 3054 GALS
90% ULLAGE= 1861 GALS
TC VOLUME = 8766 GALS
HEIGHT = 83.26 INCHES
WATER VOL = 0 GALS
WATER = 0.00 INCHES
TEMP = 76.3 DEG F

T 2:UNLEADED PREMIUM
VOLUME = 2671 GALS
ULLAGE = 5365 GALS
90% ULLAGE= 4561 GALS
TC VOLUME = 2647 GALS
HEIGHT = 43.82 INCHES
WATER VOL = 0 GALS
WATER = 0.00 INCHES
TEMP = 72.7 DEG F

T 3:DIESEL
VOLUME = 2696 GALS
ULLAGE = 7502 GALS
90% ULLAGE= 6482 GALS
TC VOLUME = 2685 GALS
HEIGHT = 37.13 INCHES
WATER VOL = 0 GALS
WATER = 0.00 INCHES
TEMP = 69.2 DEG F

* * * * * END * * * * *



06-28-01 1:05 PM

SYSTEM STATUS REPORT

T 1:LOW PRODUCT ALARM

T 1:DELIVERY NEEDED

T 2:LEAK ALARM

T 2:SUDDEN LOSS ALARM

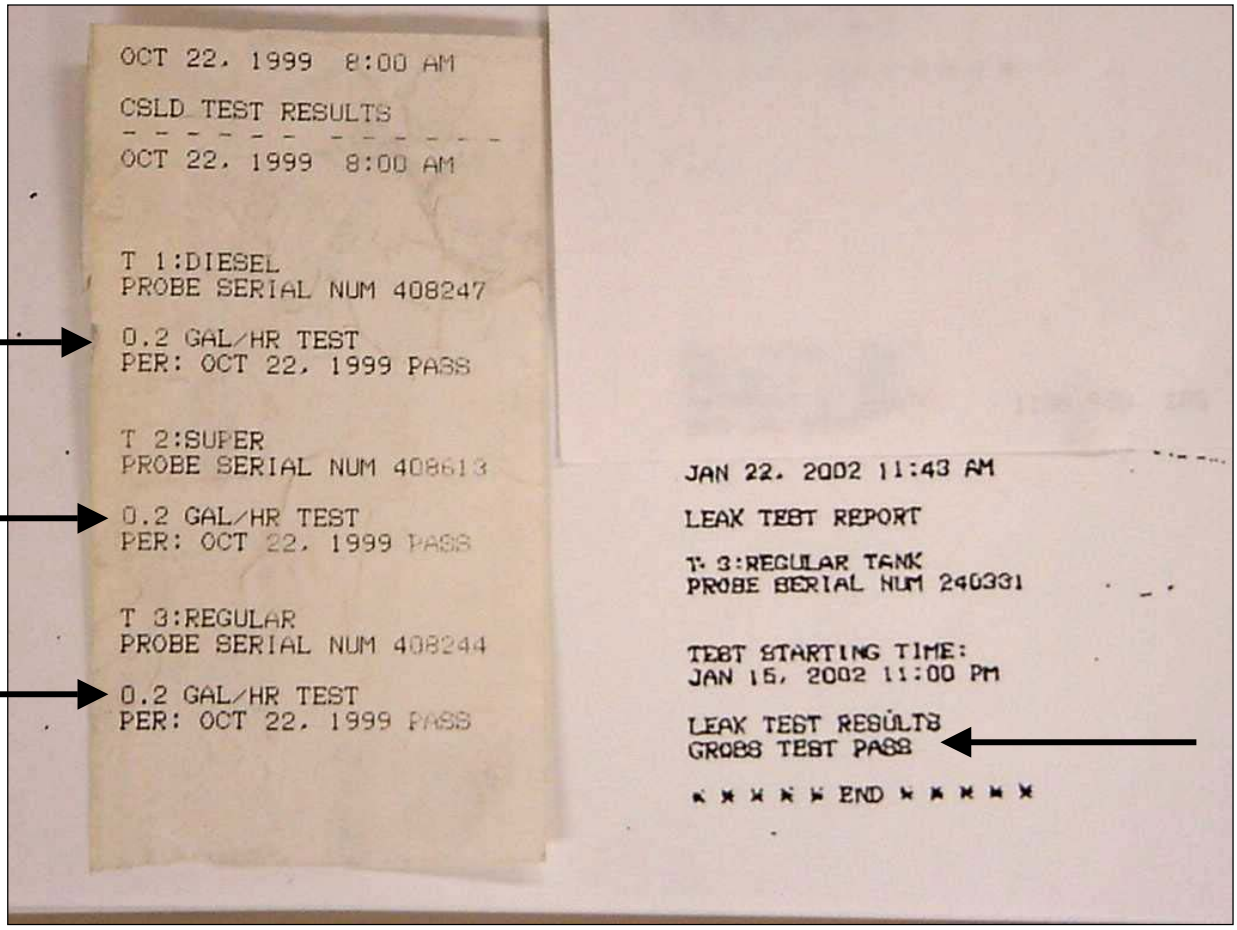
T 3:LOW PRODUCT ALARM

T 3:DELIVERY NEEDED

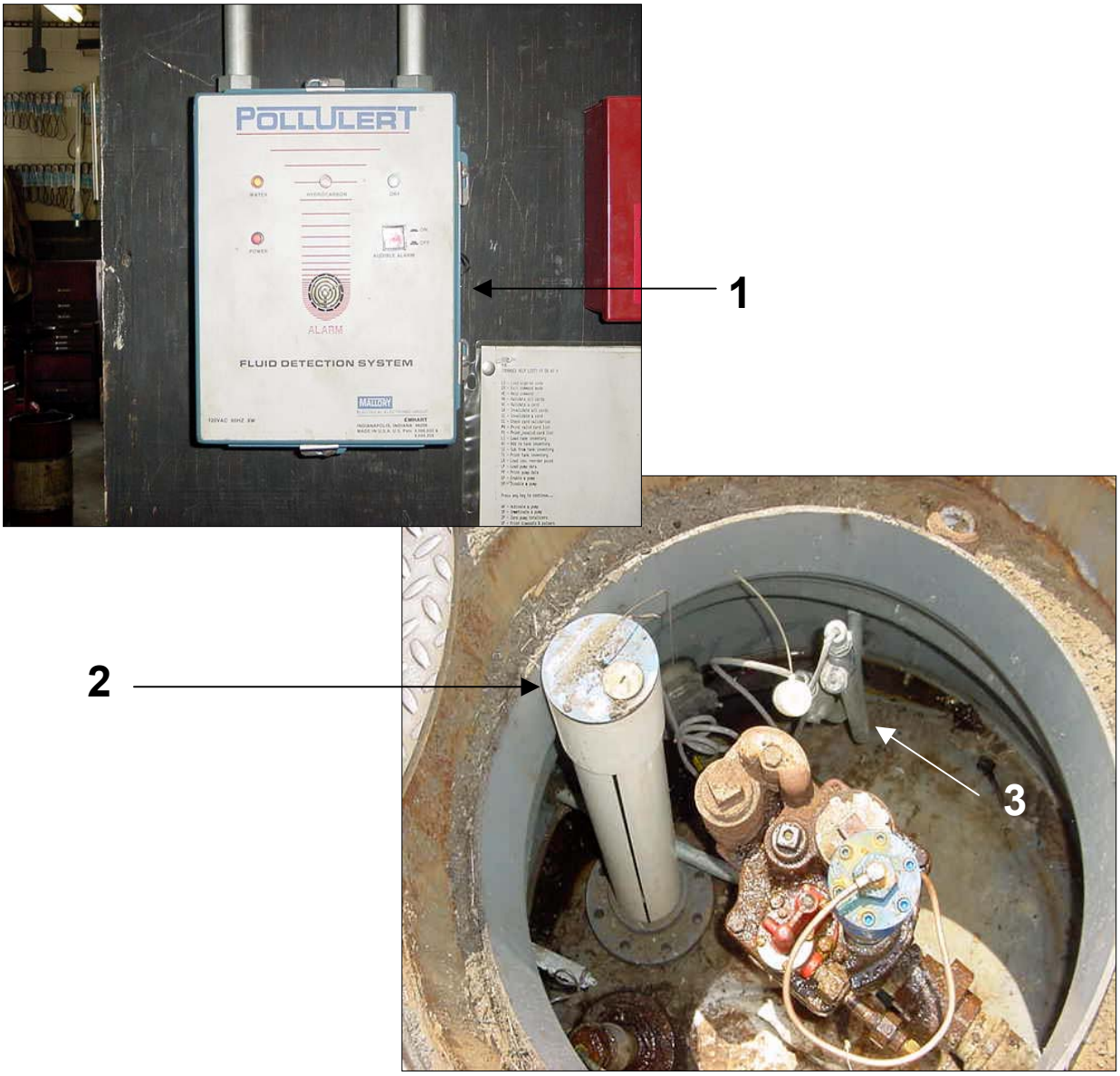
INVENTORY REPORT

T 1:DIESEL
VOLUME = 914 GALS
ULLAGE = 9086 GALS
90% ULLAGE= 8086 GALS
TC VOLUME = 908 GALS
HEIGHT = 14.12 INCHES
WATER VOL = 41 GALS

Both of these ATG panel print-out tapes are from Veeder Root systems. The one on the left shows the results of a monthly test at a 0.2 gallon per hour leak rate which meets state and federal requirements for monthly leak detection for tanks. The tape on the right shows the results of a Gross Test which is a 3-gallon-per-hour test which is not compliant for monthly leak detection. Inspection Significance: If an owner or operator provides you with records in response to your request to document monthly tank leak detection, make sure you are provided with the results of the 0.2 gallon test, not the results of a Gross Test. Also note, neither tape addresses line leak detection, and the owner or operator must also provide documentation of acceptable monthly line leak detection results.



Another type of monitoring device. The unit in photo (1) measures for the presence of liquid in the interstitial space of a double-walled UST and/or double-walled piping system. A red warning light will warn the operator of the presence of liquid in the interstitial space. Item (2), in the STP sump, is monitoring the interstitial space of the tank. Item (3) is a liquid sensor in the STP sump to monitor the double-walled piping not visible in the photo. Inspection Significance: Because the unit does not have a printer, the owner or operator must keep a logbook and make an entry each month documenting that the system has been checked and record whether there were any alarms during the previous 30-day period.



TLS-250

Automatic Tank Gauging System

VEEDER-ROOT
125 Powder Forest Dr
Simsbury, CT 06070
Tel: 203/651-2700

Evaluator: MRI - 05/14/93

System Description: *The TLS-250 is capable of sensing product loss from a tank as small as 0.2 gph. The leak detect routine is conducted while no fueling is taking place and no bulk deliveries are being made. The leak detection mode can be operated manually or set automatically for times when the facility is closed. It can be set to test a single tank or all tanks in a system. The TLS also checks itself and the fuel prior to and during a test for nine separate conditions including low inventory, recent bulk delivery and equipment problems which could cause a false test failure. The TLS system is capable of handling 8 probes.*

Certification: 0.2 gph with PD = 99% and PFA = 0.1%

Tank Capacity: Max. 15,000 gal

Test Period: Min. 2 hrs with tank 50 - 95% full

Limitations:
- No dispensing or delivery during test
- Not evaluated using manifold tanks
- Not capable of continuous monitoring
- Not equipped to monitor product lines

SAMPLE REPORTS
TLS-250

1. ***Display Inventory Information (NORMAL MODE)***

   a. **Depress** FUNCTION **until desired function**
   b. **Depress** TANK **until desired tank**

2. ***Print Inventory Information (NORMAL MODE)***

   a. **Depress** PRINT; **information for all tanks in system.**

```
Station Name
Street Name
City, State, Zip
Telephone Number

INVENTORY REPORT
FEB 6, 1987
6:30 AM

TANK 1
PREMIUM UNLEADED
  1676 GALLONS FUEL
  8324 GALS ULLAGE
 21.75 INCHES FUEL
   0.0 INCHES WATER
  55.3 DEGREES F

TANK 2
REGULAR UNLEADED
  3731 GALLONS FUEL
  6269 GALS ULLAGE
 38.37 INCHES FUEL
   0.0 INCHES WATER
  56.7 DEGREES F
```

3. ***Leak Monitor Report*** **(NORMAL MODE)**

   a. **Depress** FUNCTION **until "Leak Rate (gal/hr)"**
   b. **Depress** PRINT; **information for all tanks in system**

```
LEAK MONITOR REPORT

TEST START TIME:
FEB 6, 1987
11:00 PM

TEST HOURS 1 - 6
--------------------
 TNK1 TNK2 TNK3 TNK4

      DEGREES F
60.2 56.6 55.9 55.4

      GALLONS

 0.0  0.0 -0.3  0.0
 0.3  0.0 -2.1  0.1
 0.7  0.0 -4.0  0.1
 1.2  0.1 -5.6  0.0
 1.5  0.0 -7.1  0.0
 1.8  0.0 -9.3  0.1

      DEGREES F
55.3 56.4 55.6 55.3


FINAL LEAK RATES:

                 0.20
                GAL/HR
TANK   GAL/HR    TEST
  1     0.30    INVALID
  2     0.00    PASSED
  3    -1.55    FAILED
  4     0.01    PASSED


TANK 1
PREMIUM UNLEADED

SEG 1  TEST MIX ERR
SEG 2  TEST MIX ERR

SEG 1  DLVY MIX ERR
SEG 2  DLVY MIX ERR

TEMP CHANGE ERROR
RECENT DELIVERY

TEST ENDING TIME:
FEB 7, 1987
6:00 AM
```

SAMPLE REPORTS
TLS 250
(cont)

4. ***Alarm History Report*** **(DIAGNOSTIC MODE)**

   a. **Depress** FUNCTION **until diagnostic code** "8"
   b. **Depress** PRINT, **shows the last three occurrences of each type of alarm for this tank**

```
ALARM HISTORY REPORT
-- EXT. INPUT ON ---

MAR 13, 1987
 9:09 PM

MAR 9, 1987
 4:25 PM

MAR 6, 1987
10:25 AM
-- EXT. INPUT OFF --

MAR 13, 1987
 9:09 PM

MAR 9, 1987
 4:25 PM

MAR 6, 1987
10:35 AM

TANK 5
PRODUCT 5
------- LEAK -------

MAR 13, 1987
 1:10 AM

MAR 3, 1987
 2:15 AM

MAR 1, 1987
 4:15 AM

---- HIGH WATER ----

MAR 13, 1987
 9:06 PM

----- OVERFILL -----

FEB 23, 1987
 4:07 PM

---- LOW LIMIT -----

FEB 23, 1987
 9:04 AM

------ THEFT -------

FEB 10, 1987
12:11 AM
```

5. ***Inventory Increase Report*** **(NORMAL MODE)**

   a. **Depress** FUNCTION **until "Delivery Volume"**
   b. **Depress** PRINT; **shows last delivery**

```
TANK 1
PREMIUM UNLEADED
INVENTORY INCREASE

FEB 6, 1987
3:38 PM
   709 GALLONS FUEL
  56.7 DEGREES F

FEB 6, 1987
3:59 PM
  5685 GALLONS FUEL
  60.4 DEGREES F

  4976 NET INCREASE
```

TLS-350

Automatic Tank Gauging & Electronic Line Leak Detection System

VEEDER-ROOT
125 Powder Forest Dr
Simsbury, CT 06070
Tel: 203/651-2700

Evaluator: MRI - 03/14/95 & 06/10/96 (CSLD)

System Description: *The TLS-350 and the TLS-350R (business inventory reconciliation) are monitoring systems that can be upgraded to provide continuous statistical leak detection (CSLD) and line leak detection if the appropriate options are added to the console. The CSLD option provides continuous tank leak detection without operational shutdown. The system can also operate on various software, depending on the UST system. The TLS-350R is able to automatically gather inventory information and reconcile totals at the end of each shift, day, and period. Without the CSLD option, the TLS-350 can detect a leak of 0.1 gph; however, the UST system must be idle during the test. With the CSLD option, it is certified at 0.2 gph and can be used to test manifolded systems. Three line leak detection options are available:*

- *Volumetric Line Leak Detection (VLLD)*
- *Pressurized Line Leak Detection (PLLD) &*
- *Wireless Pressurized Line Leak Detection (WPLLD);*

all can detect 3, 0.2 and 0.1 gph. The TLS-350 is also capable of monitoring groundwater and vapor sensors. The console features a built-in beeper and warning lights for alarm conditions and can be programmed to shutdown pumps. You can verify which options are included in the system by scrolling through the functions listed on the console display.

TLS-350
(CONT)

Certification: ***TANK GAUGING***
0.1 gph with PD = 99% and PFA = 1%
With CSLD
0.2 gph with PD = 100% and PFA = 0%
LINE TEST
3, 0.2 & 0.1 gph with PD = 100% and PFA = 0%

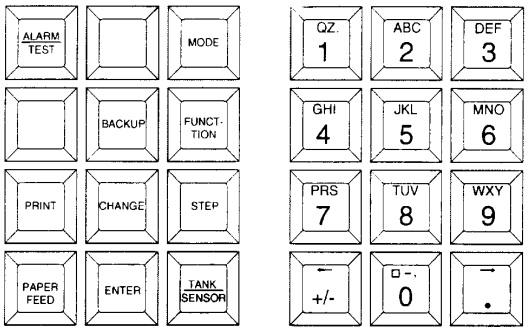
Tank Capacity: Max. 15,000 gal
Max. 38,170 gal for all manifolded tanks with CSLD

Test Period: ***TANK GAUGING***
Min. 3 hrs with tank 95% full for 0.1 gph test
Min. 2 hrs with tank 50 - 95% full for 0.2 gph test
With CSLD
No down time
LINE TEST (Depends on probe series)
3.0 gph - 14 sec to 1 min
0.2 gph - 6 to 45 min
0.1 gph - 14 to 45 min

Limitations: ***W/O CSLD option***
- No dispensing or delivery during test
- Not evaluated using manifolded tanks

W/O LLD option
- Not equipped to monitor product lines

SAMPLE REPORTS
TLS-350



Console Keypad

*1. **View Inventory Information***

a. Press **FUNCTION** until “In-Tank Inventory”
b. Press **STEP** to view inventory in first tank
c. Continue to press **STEP** for all other inventory information
d. Press **TANK** for inventory in next tank

*2. **Print Inventory Information***

a. Find “All Functions Normal” on display
b. Press **PRINT**; information for all tanks in system.

*3. **Delivery Increase Amount***

a. Press **FUNCTION** until “In-Tank Inventory”
b. Press **STEP** until “Delivery =”
c. Press **TANK** for inventory in next tank
d. Press **PRINT** for delivery in tank

```
MMM DD, YYYY HH:MM XM

INVENTORY REPORT

T 1:UNLEADED GASOLINE
VOLUME     = 8518 GALS
ULLAGE     = 1482 GALS
90% ULLAGE=  482 GALS
TC VOLUME  = 8492 GALS
HEIGHT     =76.26 INCHES
WATER VOL  =    0 GALS
WATER      = 0.00 INCHES
TEMP       = 64.6 DEG F

T 2:SUPER UNLEADED
VOLUME     = 7545 GALS
ULLAGE     = 2455 GALS
90% ULLAGE= 1455 GALS
TC VOLUME  = 7569 GALS
HEIGHT     =67.76 INCHES
WATER VOL  =    0 GALS
WATER      = 0.00 INCHES
```

```
MMM DD, YYYY HH:MM XM

T 1:REGULAR UNLEADED
INVENTORY INCREASE

INCREASE START
MMM DD, YYYY HH:MM XM

VOLUME    = 5146 GALS
HEIGHT    = 44 INCHES
WATER     = 0.00 INCHES
TEMP      = 46.8 DEG F

INCREASE END
MMM DD, YYYY HH:MM XM

VOLUME    = 8104 GALS
HEIGHT    = 84 INCHES
WATER     = 0.00 INCHES
TEMP      = 47.2 DEG F

GROSS INCREASE  = 2958
TC NET INCREASE = 2983
```

SAMPLE REPORTS
TLS-350
(cont)

4. ***Tank Leak Test Results***

a. Press **FUNCTION** until “In-Tank Test Results”
b. Press **PRINT** for all tank leak tests

```
MMM DD, YYYY HH:MM XM

LEAK TEST REPORT
T 1:REGULAR UNLEADED
PROBE SERIAL NUM 105792

TEST STARTING TIME:
MMM DD, YYYY HH:MM XM

TEST LENGTH =  4.3 HRS
STRT VOLUME = 3725 GALS


LEAK TEST RESULTS
0.2 GAL/HR TEST PASS
```

5. ***CSLD Test Results***

a. Press **FUNCTION** until “CSLD Test Results”
b. Press **PRINT** for CSLD results in all tanks

```
CSLD TEST RESULTS
- - - - - - - - - - - -
  DD-MM-YY HH:MM XM


T 2:SUPER UNLEADED
PROBE SERIAL NUM 123002
0.2 GAL/HR TEST
PER: DD-MM-YY PASS
```

6. ***Pressurized Line Leak Detection Tests (PLLD)***

a. Press **FUNCTION** until “Pressure Line Results”
b. b. Press **PRINT** for results in all lines

```
MMM DD, YYYY   HH:MM XM
PRESSURE LINE LEAK TEST
RESULTS

Q 1:UNLEADED REG LINE
3.0 GAL/HR RESULTS:

LAST TEST:
MMM DD,YYYY HH:MM XM PASS

NUMBER OF TESTS PASSED
  PREV 24 HOURS  :  123
 SINCE MIDNIGHT  :   81

0.20 GAL/HR RESULTS:

MMM DD,YYYY HH:MM XM PASS
MMM DD,YYYY HH:MM XM PASS

0.10 GAL/HR RESULTS:

MMM DD,YYYY HH:MM XM PASS
MMM DD,YYYY HH:MM XM PASS
```

SAMPLE REPORTS
TLS-350
(Cont)

7. PLLD History Reports

a. Press **FUNCTION** until “Pressure Line Results”
b. Press **STEP** until “Press Print for History”
Press **PRINT** for history; last 3 gph, first 0.2 gph & first 0.1 gph results for each month

```
MMM DD,YYYY HH:MM XM

PRESSURE LINE LEAK TEST
HISTORY

Q 1: UNLEADED REG LINE

LAST 3.0 GAL/HR PASS:
MMM DD,YYYY HH:MM XM

FIRST 0.20 GAL/HR PASS
EACH MONTH:

MMM DD,YYYY HH:MM XM
MMM DD,YYYY HH:MM XM
MMM DD,YYYY HH:MM XM
MMM DD,YYYY HH:MM XM

FIRST 0.10 GAL/HR PASS
EACH MONTH:

MMM DD,YYYY HH:MM XM
MMM DD,YYYY HH:MM XM
MMM DD,YYYY HH:MM XM
MMM DD,YYYY HH:MM XM
```

8. Wireless Pressurized Line Leak Detection Tests (WPLLD)

a. Press **FUNCTION** until “WPLLD Line Results”
b. Press **PRINT** for results of all lines

```
MMM DD, YYYY HH:MM XM

WPLLD LINE LEAK TEST
RESULTS

W 1:UNLEADED REG LINE

3.0 GAL/HR RESULTS:

LAST TEST:
MMM DD,YYYY HH:MM XM PASS

NUMBER OF TESTS PASSED
  PREV 24 HOURS  :  123
 SINCE MIDNIGHT  :   81

0.20 GAL/HR RESULTS:

MMM DD,YYYY HH:MM XM PASS
MMM DD,YYYY HH:MM XM PASS

0.10 GAL/HR RESULTS:

MMM DD,YYYY HH:MM XM PASS
MMM DD,YYYY HH:MM XM PASS
```

9. WPLLD History Reports

a. Press **FUNCTION** until “WPLLD Line Results”
b. Press **STEP** until “Press Print for History Report”
c. Press **PRINT** for history; last 3 gph, first 0.2 gph & first 0.1 gph results for each month

```
MMM DD, YYYY HH:MM XM

WPLLD LINE LEAK TEST
HISTORY

W 1: UNLEADED REG LINE

LAST 3.0 GAL/HR PASS:
MMM DD, YYYY HH:MM XM

FIRST 0.20 GAL/HR PASS
EACH MONTH:

MMM DD, YYYY HH:MM XM
MMM DD, YYYY HH:MM XM
MMM DD, YYYY HH:MM XM
MMM DD, YYYY HH:MM XM

FIRST 0.10 GAL/HR PASS
EACH MONTH:

MMM DD, YYYY HH:MM XM
MMM DD, YYYY HH:MM XM
MMM DD, YYYY HH:MM XM
MMM DD, YYYY HH:MM XM
```

SAMPLE REPORTS
TLS-350
(Cont)

10. ***Volumetric Line Leak Detection Tests (VLLD)***
(TLS-350R Only)

a. Press **FUNCTION** until "Line Leak Detect Results"
b. Press **PRINT** for history results of all lines

```
LIQUID STATUS
- - - - - - - - - - -
MMM DD,YYYY HH:MM XM


L 1 : UNLEADED ANNULAR
SENSOR NORMAL
L 2 : SUPER ANNULAR
SENSOR NORMAL
```

11. ***Liquid Status Reports***

a. Press **FUNCTION** until "Liquid Status"
b. Press **PRINT** for report for up to 64 sensors
c. Press **TANK/SENSOR** for other sensors in system
c. Press **PRINT** for report of sensor status

```
VAPOR STATUS
- - - - - - - - - - -
MMM DD,YYYY HH:MM  XM


V 1 : NORTHWEST WELL
SENSOR NORMAL
V 2 : MAIN STREET WELL
SENSOR NORMAL
```

12. ***Vapor Status Reports***

a. Press **FUNCTION** until "Vapor Status"
b. Press **PRINT** for report for up to 40 sensors
c. c. Press **TANK/SENSOR** for other sensors in system
d. Press **PRINT** for report of sensor status.

```
GROUNDWATER STATUS
- - - - - - - - - - -
MMM DD,YYYY HH:MM XM

G 1 : GROUND WATER #1
SENSOR NORMAL
G 2 : GROUND WATER #2
SENSOR NORMAL
```

13. ***Groundwater Sensor Status***

a. Press **FUNCTION** until "Groundwater Status"
b. Press **PRINT** for report for up to 40 sensors
c. Press **TANK/SENSOR** for other sensors in system
d. Press **PRINT** for report of sensor status

14. ***Alarm History Report***

a. Press **MODE** until "Diagnostic"
b. Press **FUNCTION** until "Alarm History Report"
c. Press **STEP** until desired report
d. Press **PRINT** for tank/sensor displayed
e. Press **TANK/SENSOR** to access other tanks/sensors

```
LINE LEAK ALARM
SENSOR NUMBER 1
LINE LEAK TEST FAIL
P2:UNLEADED REGULAR
MMM DD, YYYY HH:MM  XM

LINE LEAK ALARM
SENSOR NUMBER 1
LINE LEAK SHUTDOWN
P1:UNLEADED REGULAR
MMM DD, YYYY HH:MM  XM

SUBMERSIBLE PUMP 1
DISABLED
MMM DD, YYYY HH:MM  XM
```

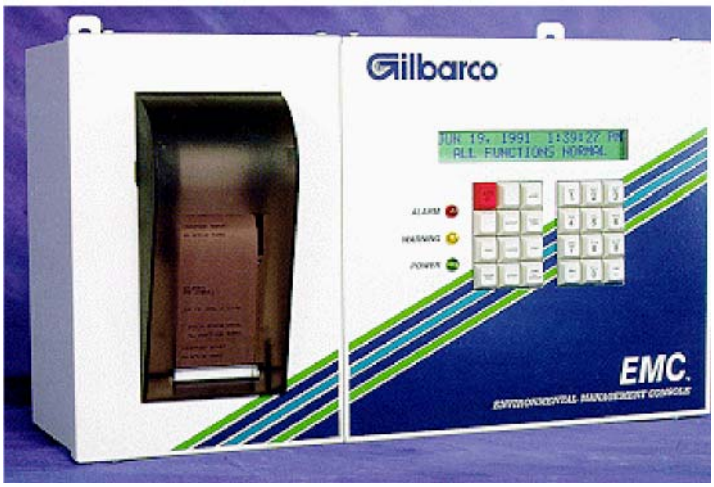
SAMPLE REPORTS
TLS-350
(Cont)

15. Leak History Report

a. Press **MODE** until “Diagnostic”
b. Press **FUNCTION** until “In-Tank Leak Result”
c. Press **STEP** until “Print Leak History”
d. Press **PRINT**

```
TANK LEAK TEST HISTORY

T 1:Unleaded

LAST GROSS TEST PASSED:
NOV  4, 1996 12:01 AM
STARTING VOLUME=  17559
PERCENT VOLUME =   89.1
TEST TYPE =  STANDARD


LAST ANNUAL TEST PASSED:

NO TEST PASSED

FULLEST ANNUAL TEST PASS

NO TEST PASSED

LAST PERIODIC TEST PASS:
SEP 29, 1998  2:54 AM
TEST LENGTH 17 HOURS
STARTING VOLUME=  11434
PERCENT VOLUME =   58.0
TEST TYPE =      CSLD


FULLEST PERIODIC TEST
PASSED EACH MONTH:

JAN 31, 1998  3:19 AM
TEST LENGTH 18 HOURS
STARTING VOLUME=  12276
PERCENT VOLUME =   62.3
TEST TYPE =      CSLD


FEB 28, 1998  4:29 AM
TEST LENGTH 19 HOURS
STARTING VOLUME=  14183
PERCENT VOLUME =   72.0
TEST TYPE =      CSLD


MAR 31, 1998  3:37 AM
TEST LENGTH 19 HOURS
STARTING VOLUME=  14377
PERCENT VOLUME =   73.0
TEST TYPE =      CSLD


APR 30, 1998  4:05 AM
TEST LENGTH 19 HOURS
STARTING VOLUME=  13792
PERCENT VOLUME =   70.0
TEST TYPE =      CSLD


MAY 31, 1998  4:00 AM
TEST LENGTH 20 HOURS
STARTING VOLUME=  11188
PERCENT VOLUME =   56.8
TEST TYPE =      CSLD


JUN 29, 1998  4:10 AM
TEST LENGTH 21 HOURS
STARTING VOLUME=  10282
PERCENT VOLUME =   52.2
TEST TYPE =      CSLD


JUL 31, 1998  4:50 AM
TEST LENGTH 19 HOURS
STARTING VOLUME=  16397
PERCENT VOLUME =   83.2
TEST TYPE =      CSLD


AUG 30, 1998  4:42 AM
TEST LENGTH 21 HOURS
STARTING VOLUME=  11794
PERCENT VOLUME =   59.9
TEST TYPE =      CSLD


SEP 29, 1998  2:54 AM
TEST LENGTH 17 HOURS
STARTING VOLUME=  11434
PERCENT VOLUME =   58.0
TEST TYPE =      CSLD


OCT 31, 1997  4:39 AM
TEST LENGTH 18 HOURS
STARTING VOLUME=  11434
PERCENT VOLUME =   58.0
TEST TYPE =      CSLD


NOV  4, 1996 12:01 AM
TEST LENGTH  2 HOURS
STARTING VOLUME=  17559
PERCENT VOLUME =   89.1
TEST TYPE =  STANDARD


DEC  1, 1996 11:56 AM
TEST LENGTH 128 HOURS
STARTING VOLUME=  17543
PERCENT VOLUME =   89.0
TEST TYPE =      CSLD
```

EMC ENVIRONMENTAL MANAGEMENT CONSOLE



Automatic Tank Gauging & Electronic Line Leak Detection System

GILBARCO
7300 West Friendly
Greensboro, NC 27420
Tel: 910/547-5000

Evaluator: MRI - 05/14/93

System Description: ***The EMC is manufactured by the same company that manufactures the TLS-350. It operates and looks similar to the TLS-350. Refer to the TLS-350 information sheets for system description and instructions for obtaining reports.***

Certification: ***TANK GAUGING***
0.1 gph with PD = 99% and PFA = 1%
With CSLD
0.2 gph with PD = 100% and PFA = 0%
LINE TEST
3, 0.2 & 0.1 gph with PD = 100% and PFA = 0%

Tank Capacity: Max. 15,000 gal
Max. 38,170 gal for all manifolded tanks with CSLD

Test Period: ***TANK GAUGING***
Min. 3 hrs with tank 95% full for 0.1 gph test
Min. 2 hrs with tank 50 - 95% full for 0.2 gph test
With CSLD
No down time

WILCO

Fuel Management and Compliance Service

Receiver

SIMMONS
106 East Main Street
Richardson, TX 75081
Tel: (800) 848-8378


Keypad/Display Unit


ATG Probe/Transmitter


Evaluator: **S.S.G.**

Associates - 10/28/95

System Description: *The Wilco system employs radio and modem communications technology to connect on-site monitoring equipment to the Simmons Cental Monitoring Center. Technicians collect and process data, monitor and respond to alarms and generate compliance reports. The Wilco ATG probe uses micro-impulse radar technology to measure tank levels and then transmits data via radio signal to a remote receiver linked to the Wilco Control Panel. The Wilco control panel with user keypad and display unit then sends data between the business and Simmons central monitoring center via existing telephone lines. Inventory, sales and delivery data are then used to produce SIR results. Sales and deliveries must be entered manually through the keypad.* ***Options*** *include* ***leak detection sensor*** *and* ***overfill*** *alarms.*

Certification: SIR 5.7 L.M. version; 0.2 & 0.1 GPH with PD = 99% & PFA = 1%

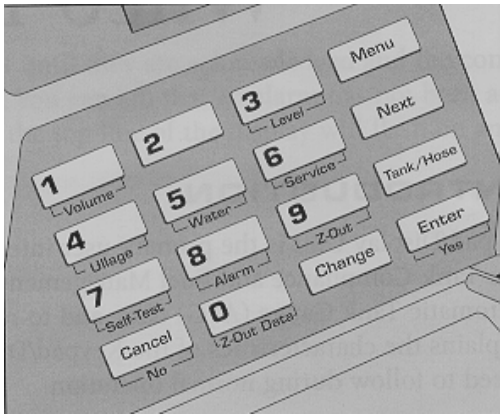
Tank Capacity: 45,000 gal.; 2, 3 or 4 tank manifolded systems

Test Period: Min. 26 days

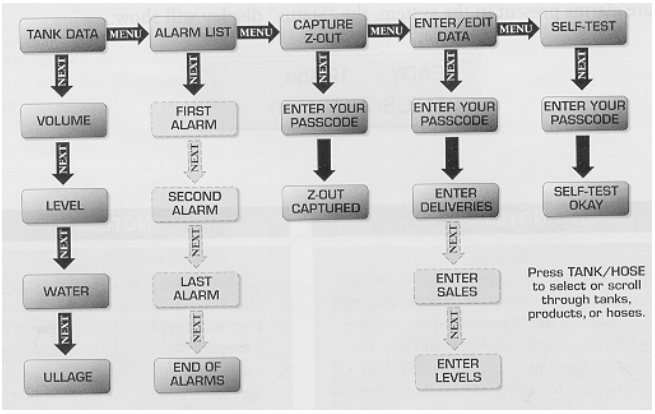
Limitations: Data collection **only**

WILCO

Keypad Operation



Keypad/Display Unit



Flowchart of Wilco Menu

1. ***Tank Inventory***

   a. Press **"Menu"** until Tank Data
   b. Press **"Next"** for Volume, Level, Water or Ullage
   c. Press **"Tank/Hose"** for different tanks in system

2. ***Alarm List***

   a. Press **"Menu"** until Alarm List
   b. Press **"Next"** for each alarm
      i. alarm description will flash on and off to indicate alarm has not been acknowledged
      ii. if alarm status is still present, second line will indicate **"ACTIVE"**
      iii. if alarm status is not present, second line will indicate **"CLEARED"**

3. ***Self-Test (system functioning properly)***

   a. Press **"Menu"** until Self-Test
   b. Press **"Next"**; enter passcode (1234)
      i. Display will show **SELFTEST OK** if functioning properly
      ii. Display will show **SELFTEST FAIL** or **PRESS SERVICE** if not functioning properly

4. ***Overfill Alarm Check***

   a. Initiate **Self-Test**, alarm should sound; *if not*, no overfill alarm
   b. Press **"Cancel"** to silence alarm

TS-1000 & 2000

Automatic Tank Gauging & Electronic Line Leak Detection System

INCON
PO Box 638
Saco, ME 04072
Tel: (207) 283-0156

Evaluator: Ken Wilcox Associates - 08/05/92

System Description: *The TS-1000/2000 is a monitoring system that can test and gauge 2 or 4 tank systems. In addition, the TS-1000/2000 can be optionally equipped with up to 8 leak detection sensors to support interstitial, sump, vapor and groundwater monitoring. Alarms can be setup to sound audibly or control relay contacts for high product levels, high water levels and tank leaks. An optional relay output BriteBox accessory unit may be configured to shut-off product dispenser pumps or to turn on/off other devices. The system can also be equipped with optional* ***TS-LLD*** *line leak detection software. Reports are obtained in the same manner as the RLM5000. See RLM5000 sample reports for more instructions.*

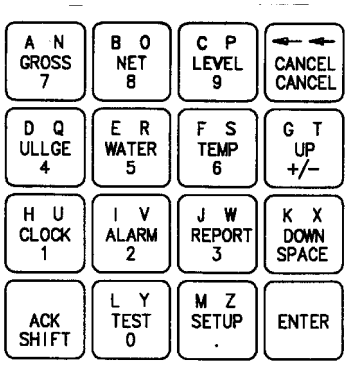
Certification: ***TANK GAUGING***
0.2 gph with PD = 99.9% and PFA = 0.1%
LINE TEST
3, 0.2 & 0.1 gph with PD = 100% and PFA = 0%

Tank Capacity: Max. 15,000 gal

Test Period: Min. 5 hrs with tank 50 - 95% full ***(TS-1000)***
Min. 3 hrs with tank 50 - 95% full ***(TS-2000)***

Limitations: - No dispensing or delivery during test
- Not evaluated using manifolded tanks

SAMPLE REPORTS
TS-1000



Reports Available

1. **Inventory**
2. **Reconciliation**
3. **Delivery**
4. **Delivery History**
5. **Leak Test**
6. **Leak Time Estimate**
7. **Alarm**
8. **Alarm History**
9. **Line Test**
10. **Line Test History**
11. **Alarm Status and Configuration**
12. **System Configuration**
13. **Tank Configuration**

Console Keypad

1. To Print Desired Report

a. Press **REPORT** key
b. Press **UP** or **DOWN** until desired report
c. Press **ENTER**
d. If prompted, enter tank number or 0 for all tanks
e. Press **ENTER** to print report

```
      JOHNS GAS STOP
        111 OAK ST.
   BIDDEFORD, ME 04005
        SITE # 001

7/25/1990        02:09 PM
     INVENTORY REPORT

TANK NO. 1       8000 GAL
      UNLEADED REG

GROSS          5051.7 GAL
NET            5024.7 GAL
PROD LEVEL      57.918 IN
ULLAGE         2963.4 GAL
TEMPERATURE      67.606 F
WATER LEVEL      0.584 IN
WATER VOL         6.4 GAL
```

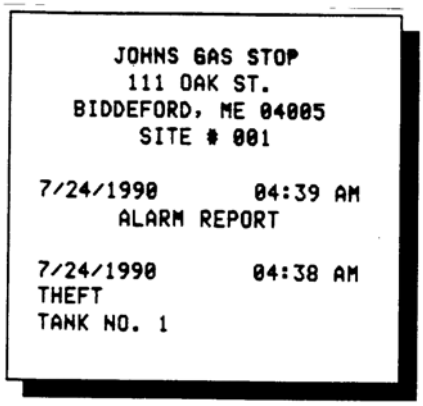
Inventory Report

```
      JOHNS GAS STOP
        111 OAK ST.
   BIDDEFORD, ME 04005
        SITE # 001

7/25/1990        02:11 PM
     LEAK TEST REPORT

TANK NO. 1       8000 GAL
      UNLEADED REG

THRESHOLD      0.20 GAL/HR
CONFIDENCE LEVEL   95.0%
TEST STARTED     12:00 AM
TEST STARTED  07/25/1990
LAST DELIVERY     6:13 AM
LAST DELIVERY 07/24/1990
% GROSS CAPACITY   73.68
BEGIN GROSS     5903.8 GAL
BEGIN NET       5869.2 GAL
BEGIN LEVEL      66.311 IN
BEGIN TEMP       68.334 F
BEGIN WATER       6.5 GAL
BEGIN WATER      0.584 IN
END TIME          1:59 AM
END DATE      07/25/1990
END GROSS       5903.4 GAL
END NET         5869.3 GAL
END LEVEL        66.307 IN
END TEMP         68.219 F
END WATER         6.5 GAL
END WATER        0.584 IN

      HOURLY DATA

TIME      DEG F  GAL
 1:00 AM 68.276 5875.68
 1:59 AM 68.219 5875.72

SLOPE          0.04 GAL/HR
SLOPE LOW      0.04 GAL/HR
SLOPE HIGH     0.04 GAL/HR
TEST RESULTS       PASSED
```

Leak Test Report

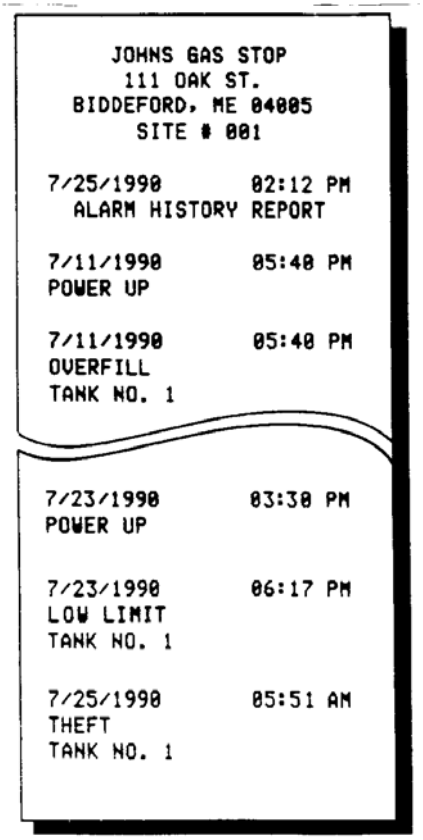
SAMPLE REPORTS
TS-1000

(cont)



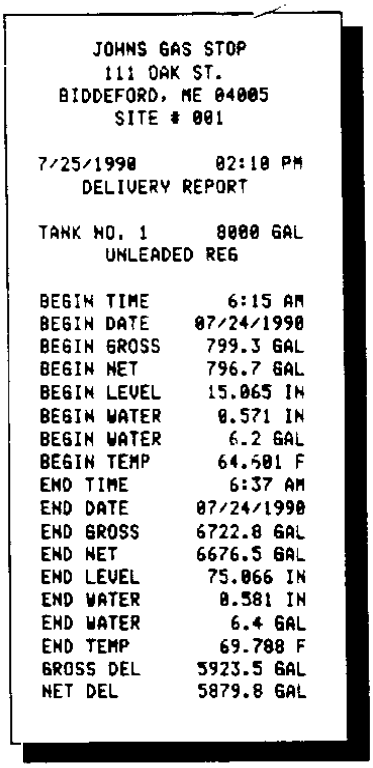
```
      JOHNS GAS STOP
        111 OAK ST.
   BIDDEFORD, ME 04005
        SITE # 001

7/24/1990          04:39 AM
       ALARM REPORT

7/24/1990          04:38 AM
THEFT
TANK NO. 1
```

Alarm Report



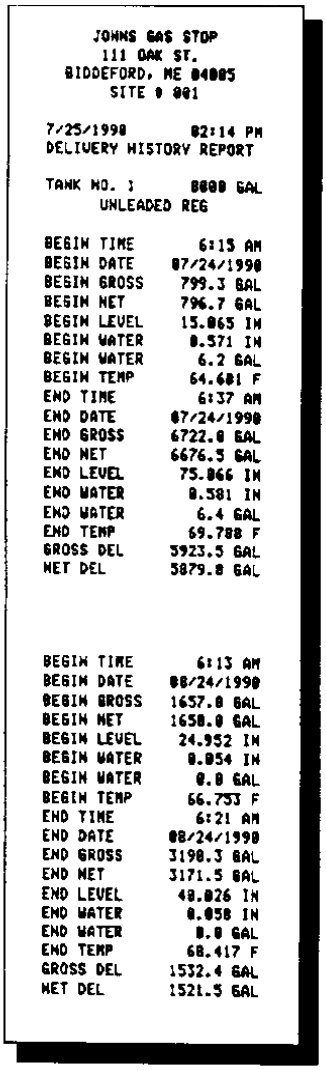
```
      JOHNS GAS STOP
        111 OAK ST.
   BIDDEFORD, ME 04005
        SITE # 001

7/25/1990          02:12 PM
  ALARM HISTORY REPORT

7/11/1990          05:40 PM
POWER UP

7/11/1990          05:40 PM
OVERFILL
TANK NO. 1

7/23/1990          03:30 PM
POWER UP

7/23/1990          06:17 PM
LOW LIMIT
TANK NO. 1

7/25/1990          05:51 AM
THEFT
TANK NO. 1
```

Alarm History Report



```
      JOHNS GAS STOP
        111 OAK ST.
   BIDDEFORD, ME 04005
        SITE # 001

7/25/1990          02:10 PM
    DELIVERY REPORT

TANK NO. 1         8000 GAL
      UNLEADED REG

BEGIN TIME          6:15 AM
BEGIN DATE       07/24/1990
BEGIN GROSS       799.3 GAL
BEGIN NET         796.7 GAL
BEGIN LEVEL      15.065 IN
BEGIN WATER       0.571 IN
BEGIN WATER        6.2 GAL
BEGIN TEMP        64.581 F
END TIME            6:37 AM
END DATE         07/24/1990
END GROSS        6722.8 GAL
END NET          6676.5 GAL
END LEVEL         75.066 IN
END WATER         0.581 IN
END WATER          6.4 GAL
END TEMP          69.788 F
GROSS DEL        5923.5 GAL
NET DEL          5879.8 GAL
```

Delivery Report



```
      JOHNS GAS STOP
        111 OAK ST.
   BIDDEFORD, ME 04005
        SITE # 001

7/25/1990          02:14 PM
DELIVERY HISTORY REPORT

TANK NO. 1         8000 GAL
      UNLEADED REG

BEGIN TIME          6:15 AM
BEGIN DATE       07/24/1990
BEGIN GROSS       799.3 GAL
BEGIN NET         796.7 GAL
BEGIN LEVEL      15.065 IN
BEGIN WATER       0.571 IN
BEGIN WATER        6.2 GAL
BEGIN TEMP        64.581 F
END TIME            6:37 AM
END DATE         07/24/1990
END GROSS        6722.8 GAL
END NET          6676.5 GAL
END LEVEL         75.066 IN
END WATER         0.581 IN
END WATER          6.4 GAL
END TEMP          69.788 F
GROSS DEL        5923.5 GAL
NET DEL          5879.8 GAL



BEGIN TIME          6:13 AM
BEGIN DATE       08/24/1990
BEGIN GROSS      1657.8 GAL
BEGIN NET        1658.0 GAL
BEGIN LEVEL       24.952 IN
BEGIN WATER       0.054 IN
BEGIN WATER        0.0 GAL
BEGIN TEMP        66.753 F
END TIME            6:21 AM
END DATE         08/24/1990
END GROSS        3198.3 GAL
END NET          3171.5 GAL
END LEVEL         48.026 IN
END WATER         0.058 IN
END WATER          0.0 GAL
END TEMP          68.417 F
GROSS DEL        1532.4 GAL
NET DEL          1521.5 GAL
```

Delivery History Report

TS-1001

Automatic Tank Gauging & Electronic Line Leak Detection System

INCON
PO Box 638
Saco, ME 04072
Tel: 207/283-0156

Evaluator: Ken Wilcox Associates - 09/05/97

System Description: *The TS-1001 can monitor product in up to 4 tanks and also monitor up to 12 leak detection sensors internally. In addition, the TS-1001 can be optionally equipped with 1 or 2 external sensor expansion modules for an additional 8 or 16 sensor inputs capable of monitoring double-walled tanks, containment sumps, dispenser pans, and vapor or groundwater monitoring wells. Alarms can be setup to sound audibly or control relay contacts for high product levels, high water levels and tank leaks. The console may also be configured to shut-off product dispenser pumps or to turn on/off other devices. Optional equipment includes overfill alarms, interface with line leak detection (TS-LLD) and SCALD (Statistical and Continuous Automatic Leak Detection; not 3rd party certified) software.* *(See TS-2001 for sample reports)*

Certification: **TANK GAUGING**
0.2 & 0.1 gph with PD = 99.9% and PFA = 0.1%
0.2 gph with (LL2 probe)

Tank Capacity: Max. 15,000 gal (30,000 gal with LL2 probe)

Test Period: Min. 5 hrs (average time to collect quality data)
Can be tested at less than 50% capacity

Limitations:
- No dispensing or delivery during test
- Not evaluated using manifolded tanks

TS-2001

Automatic Tank Gauging & Electronic Line Leak Detection System

INCON
PO Box 638
Saco, ME 04072
Tel: (207) 283-0156

Evaluator: Ken Wilcox Associates - 09/05/97

System Description: *The TS-2001 can monitor product in up to 8 tanks and also monitor up to 24 leak detection sensors internally. In addition, the TS-2001 can be optionally equipped with 1 or 2 external sensor expansion modules for an additional 8 or 16 sensor inputs capable of monitoring double-walled tanks, containment sumps, dispenser pans, and vapor or groundwater monitoring wells. Alarms can be setup to sound audibly or control relay contacts for high product levels, high water levels and tank leaks. The console may also be configured to shut-off product dispenser pumps or to turn on/off other devices. Optional equipment includes overfill alarms, interface with line leak detection (TS-LLD) and SCALD (Statistical and Continuous Automatic Leak Detection; not 3rd party certified) software.*

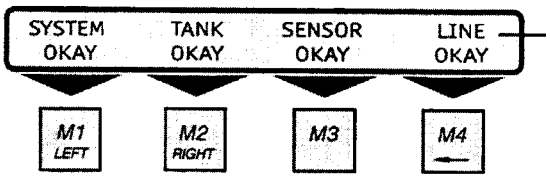
Certification: **TANK GAUGING**
0.2 & 0.1 gph with PD = 99.9% and PFA = 0.1%
0.2 gph with (LL2 probe)

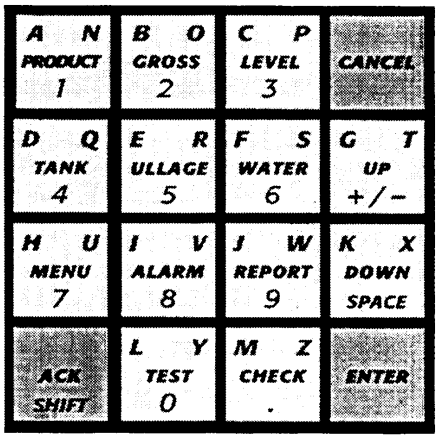
Tank Capacity: Max. 15,000 gal (30,000 gal with LL2 probe)

Test Period: Min. 5 hrs (average time to collect quality data)
Can be tested at less than 50% capacity

Limitations:
- No dispensing or delivery during test
- Not evaluated using manifolded tanks

SAMPLE REPORTS
TS-1001/2001





Console Keypad

2. To Print Inventory Report

a. Press **REPORT** key
b. Press **M 1**
c. Press **M 4**
d. Press **M 1**

3. To Print Inventory Summary Report

a. Press **REPORT** key
b. Press **M 1**
c. Press **M 2**
d. Press **M 1**

1. To Print Desired Report

a. Press **REPORT** key
b. Press **DOWN** key to make choices
c. Press menu keys **(M1 - M4)** to make selection

```
          INCON
INTELLIGENT CONTROLS INC
     P. O. BOX 638
     SACO ME 04072
     1-800-984-6266

08/13/1998        9:46 AM

 TANK INVENTORY DETAIL

          TANK 1

TANK NO. 1    11882.3 GAL
PRODUCT          UNLD REG
GROSS          7143.7 GAL
NET            7085.2 GAL
PROD LEVEL      54.003 IN
GROSS CAPACITY     60.2%
ULLAGE         4131.7 GAL
TEMPERATURE      71.621 F
WATER LEVEL      0.686 IN
WATER VOLUME     12.8 GAL


          TANK 2

TANK NO. 2     5092.7 GAL
PRODUCT         UNLD PLUS
GROSS          2037.9 GAL
NET            2020.5 GAL
PROD LEVEL      40.441 IN
GROSS CAPACITY     40.0%
ULLAGE         2800.1 GAL
TEMPERATURE      72.235 F
WATER LEVEL      0.000 IN
WATER VOLUME      0.0 GAL
```

```
          INCON
INTELLIGENT CONTROLS INC
     P. O. BOX 638
     SACO ME 04072
     1-800-984-6266

08/11/1998        7:26 PM

 TANK INVENTORY SUMMARY

    ( GROSS VOLUME )

TANK 1        11498.6 GAL
TANK 2         4097.6 GAL
TANK 3         4016.5 GAL
```

SAMPLE REPORTS
TS-1001/2001
(cont)

4. To Print Leak Test Report

a. Press **REPORT** key
b. Press **M 4**
c. Press **M 2**
d. Press **M 2** (**M 3** for history report)
e. Press **M 1**

5. To Print SCALD Test Report

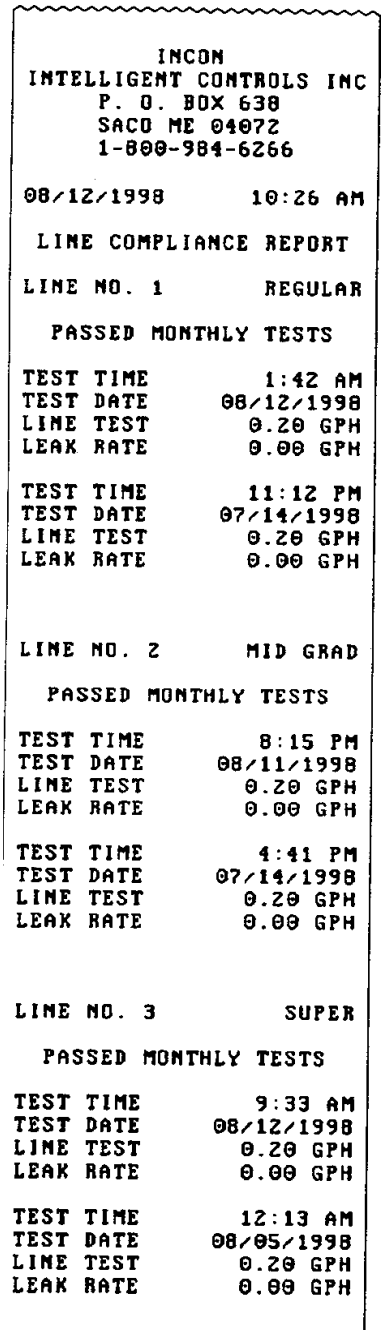
a. Press **REPORT** key
b. Press **M 4**
c. Press **M 4**
d. Press **M 1**

```
          INCON
 INTELLIGENT CONTROLS INC
      P. O. BOX 638
      SACO ME 04072
      1-800-984-6266

10/18/1997          02:42

    LEAK TEST REPORT

PLUS 2          5014.3 GAL
          PLUS

LEAK TEST       0.100 G/H
LEAK THRESHOLD 0.050 G/H
CONFIDENCE LEVEL   99.0%
TEST STARTED        21:45
TEST STARTED  10/17/1997
GROSS CAPACITY     56.12%
BEGIN GROSS    2814.2 GAL
BEGIN NET      2808.8 GAL
BEGIN LEVEL     52.630 IN
BEGIN TEMP       62.720 F
BEGIN WATER       0.4 GAL
BEGIN WATER      0.130 IN
END TIME             2:39
END DATE       10/18/1997
END GROSS      2814.3 GAL
END NET        2808.6 GAL
END LEVEL       52.632 IN
END TEMP         62.878 F
END WATER         0.4 GAL
END WATER        0.131 IN

       HOURLY DATA

TIME       DEG F   GAL
22:44     62.721  2809.23
23:44     62.751  2808.78
 0:44     62.885  2809.07
 1:44     62.883  2809.09

SLOPE          -0.04 GAL/HR
SLOPE LOW      -0.04 GAL/HR
SLOPE HIGH     -0.04 GAL/HR
TEST RESULTS       PASSED
SLOPE EQUALS CALCULATED
LEAK RATE
```

```
          INCON
 INTELLIGENT CONTROLS INC
      P. O. BOX 638
      SACO ME 04072
      1-800-984-6266

08/13/1998        9:56 AM

   SCALD TEST REPORT

TANK 1         11882.3 GAL
        UNLD REG

LEAK TEST       0.200 GPH
LEAK THRESHOLD 0.100 GPH
EXTENT           18.0 HRS
VOL QUALIFY         0.0%
TEST STARTED     12:22 PM
TEST STARTED   08/07/1998
SALES RATE     54.731 GPH
EVAPORATED      1.781 GAL
LOST            0.327 GAL
DUTY FACTOR          0.31
UPDATED          12:40 AM
UPDATED        08/10/1998

SLOPE       -0.002 GAL/HR
TEST RESULT        PASSED
SLOPE EQUALS CALCULATED
LEAK RATE



TANK 2         5092.7 GAL
        UNLD PLUS

LEAK TEST       0.200 GPH
LEAK THRESHOLD 0.100 GPH
EXTENT           18.0 HRS
VOL QUALIFY         0.0%
TEST STARTED      9:41 PM
TEST STARTED   08/09/1998
SALES RATE      8.096 GPH
EVAPORATED      0.050 GAL
LOST           -0.090 GAL
DUTY FACTOR          0.79
UPDATED           1:42 AM
UPDATED        08/11/1998

SLOPE       -0.053 GAL/HR
TEST RESULT        PASSED
SLOPE EQUALS CALCULATED
LEAK RATE
```

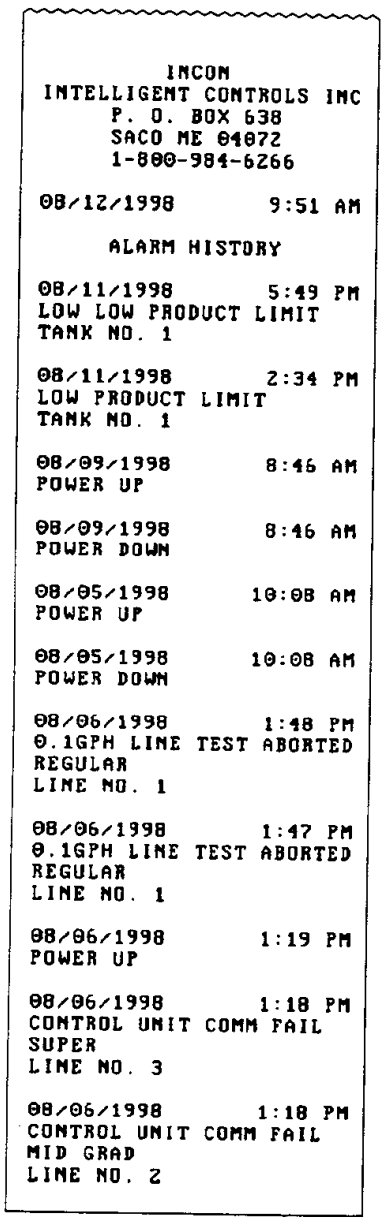
SAMPLE REPORTS
TS-1001/2001
(cont)

6. ***To Print Line Compliance Report***
   a. Press **REPORT** key
   b. Press **M 3**
   c. Press **M 1** (**M 3** for history report)
   d. Press **M 1**



```
          INCON
 INTELLIGENT CONTROLS INC
      P. O. BOX 638
      SACO ME 04072
      1-800-984-6266

08/12/1998        10:26 AM

 LINE COMPLIANCE REPORT

LINE NO. 1         REGULAR

  PASSED MONTHLY TESTS

TEST TIME           1:42 AM
TEST DATE       08/12/1998
LINE TEST         0.20 GPH
LEAK RATE         0.00 GPH

TEST TIME          11:12 PM
TEST DATE       07/14/1998
LINE TEST         0.20 GPH
LEAK RATE         0.00 GPH



LINE NO. 2         MID GRAD

  PASSED MONTHLY TESTS

TEST TIME           8:15 PM
TEST DATE       08/11/1998
LINE TEST         0.20 GPH
LEAK RATE         0.00 GPH

TEST TIME           4:41 PM
TEST DATE       07/14/1998
LINE TEST         0.20 GPH
LEAK RATE         0.00 GPH



LINE NO. 3           SUPER

  PASSED MONTHLY TESTS

TEST TIME           9:33 AM
TEST DATE       08/12/1998
LINE TEST         0.20 GPH
LEAK RATE         0.00 GPH

TEST TIME          12:13 AM
TEST DATE       08/05/1998
LINE TEST         0.20 GPH
LEAK RATE         0.00 GPH
```

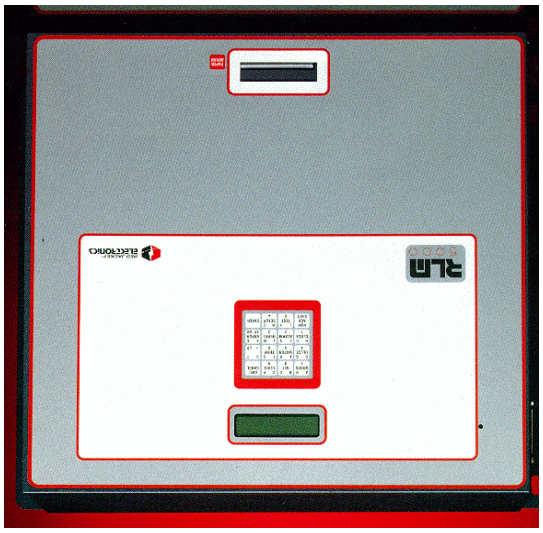
7. ***To Print Alarm/Sensor Reports***
   a. Press **REPORT** key
   b. Press **DOWN/SPACE** key
   c. Press **M 2** (**M1** for sensors)
   d. Press desired **M** key report



```
          INCON
 INTELLIGENT CONTROLS INC
      P. O. BOX 638
      SACO ME 04072
      1-800-984-6266

08/12/1998         9:51 AM

      ALARM HISTORY

08/11/1998         5:49 PM
LOW LOW PRODUCT LIMIT
TANK NO. 1

08/11/1998         2:34 PM
LOW PRODUCT LIMIT
TANK NO. 1

08/09/1998         8:46 AM
POWER UP

08/09/1998         8:46 AM
POWER DOWN

08/05/1998        10:08 AM
POWER UP

08/05/1998        10:08 AM
POWER DOWN

08/06/1998         1:48 PM
0.1GPH LINE TEST ABORTED
REGULAR
LINE NO. 1

08/06/1998         1:47 PM
0.1GPH LINE TEST ABORTED
REGULAR
LINE NO. 1

08/06/1998         1:19 PM
POWER UP

08/06/1998         1:18 PM
CONTROL UNIT COMM FAIL
SUPER
LINE NO. 3

08/06/1998         1:18 PM
CONTROL UNIT COMM FAIL
MID GRAD
LINE NO. 2
```

RLM 5000

Automatic Tank Gauging System



Red Jacket
Marley Pump Co.
9650 Alden Rd.
Lenexa, KS 66215
Tel: 913/541-2985

Evaluator: **KWA - 04/02/91**

System Description: *The RLM 5000 operates as the central processing unit and data collection center for leak detection and inventory management. It collects level and temperature data from up to eight magnetostrictive level probes and computes various volumetric quantities, correcting all volumes for temperature. The operator may choose from among various reports as well as generate a complete set of inventory, operation and leak detection reports. These reports may be printed on demand or prescheduled. All alarms generate reports immediately and may be programmed to activate one of the two relay outputs. The RLM 5001* adds the feature of vapor and liquid detection sensors.

Certification: 0.2 gph with PD = 100% and PFA = 0%

Tank Capacity: Max. 15,000 gal

Test Period: Min. 3 hrs with tank 50 - 95% full

Limitations:
- No dispensing or delivery during test
- Not evaluated using manifolded tanks
- Not capable of monitoring product lines
- Not capable of continuous monitoring

SAMPLE REPORTS
RLM 5000

1. ***Inventory Report (non- temp comp)***

   a. Press **RPRT** key
   b. Press **UP** or **DN** key till “Inventory”
   c. Press **ENTER** key
   d. Press **1 - 8** for desired tank or **0** for all tanks
   e. Press **ENTER** key

2. ***Reconciliation Report (temp comp)***

   a. Press **RPRT** key
   b. Press **UP** or **DN** key till “Reconcil”
   c. Press **ENTER** key
   d. Press **1 - 8** for desired tank or **0** for all tanks
   e. Press **ENTER** key

3. ***Delivery Report***

   a. Press **RPRT** key
   b. Press **UP** or **DN** key till “Delivery”
   c. Press **ENTER** key
   d. Press **1 - 8** for desired tank or **0** for all tanks
   e. Press **ENTER** key

4. ***Delivery History Report (if programmed)***

   a. Press **RPRT** key
   b. Press **UP** or **DN** key till “Del Hist”
   c. Press **ENTER** key
   d. Press **1 - 8** for desired tank or **0** for all tanks
   e. Press **ENTER** key

5. ***Leak Test Report***

   a. Press **RPRT** key
   b. Press **UP** or **DN** key till “Leak”
   c. Press **ENTER** key
   d. Press **1 - 8** for desired tank or **0** for all tanks
   e. Press **ENTER** key

```
   RED JACKET TECH LINE
      1-800-468-7867
       MISSION, KS
         SITE #

1/1/1964          12:14 AM
    INVENTORY REPORT

TANK NO. 1              GAL


GROSS            2285.3 GAL
NET              2259.9 GAL
PROD LEVEL        36.821 IN
ULLAGE           3682.6 GAL
TEMPERATURE        75.737 F
WATER LEVEL         1.963 IN
WATER VOL          45.0 GAL
```

```
  RED JACKET TECH LINE
     1-800-468-7867
      MISSION, KS
        SITE #

1/7/1964          10:50 PM
    LEAK TEST REPORT

TANK NO. 1              GAL


THRESHOLD      0.20 GAL/HR
CONFIDENCE LEVEL    95.0%
TEST STARTED       3:42 AM
TEST STARTED   01/03/1964
% GROSS CAPACITY    39.90
BEGIN GROSS    2399.4 GAL
BEGIN NET      2371.2 GAL
BEGIN LEVEL     37.802 IN
BEGIN TEMP       76.640 F
BEGIN WATER      16.1 GAL
BEGIN WATER      0.738 IN
END TIME          5:22 AM
END DATE       01/03/1964
END GROSS      2399.4 GAL
END NET        2372.0 GAL
END LEVEL       37.802 IN
END TEMP         76.209 F
END WATER        16.1 GAL
END WATER        0.738 IN

      HOURLY DATA

TIME      DEG F   GAL
 4:42 AM 76.350  2387.88

SLOPE          0.54 GAL/HR
SLOPE LOW      0.54 GAL/HR
SLOPE HIGH     0.55 GAL/HR
TEST RESULTS       PASSED
```

SAMPLE REPORTS
RLM 5000
(Cont)

6. ***Leak Estimate Report (length of test)***

a. Press **RPRT** key
b. Press **UP** or **DN** key till “Leak Est”
c. Press **ENTER** key
d. Press **1 - 8** for desired tank or **0** for all tanks
e. Press **ENTER** key

```
  RED JACKET TECH LINE
     1-800-468-7867
      MISSION, KS
        SITE #

1/1/1964          12:02 AM
  LEAK ESTIMATE REPORT

TANK NO. 1              GAL


THRESHOLD     0.10 GAL/HR
CONFIDENCE LEVEL    97.5%
PERCENT CAPACITY    38.75
GROSS           2285.3 GAL
NET             2259.7 GAL
LEVEL            36.821 IN
TEMP              75.867 F
WATER VOL          45.0 GAL
WATER LEVEL       1.964 IN
EST TIME     3 HRS 20 MIN
```

7. ***Alarm History Report***

a. Press **RPRT** key
b. Press **UP** or **DN** key till “Alarm Hist”
c. Press **ENTER** key
d. Press **1 - 8** for desired tank or **0** for all tanks
e. Press **ENTER** key; last 50 alarms

8. ***Alarm Status Report (current alarms)***

a. Press **RPRT** key
b. Press **UP** or **DN** key till “Alarm Stat”
c. Press **ENTER** key
d. Press **1 - 8** for desired tank or **0** for all tanks
e. Press **ENTER** key

```
  RED JACKET TECH LINE
     1-800-468-7867
      MISSION, KS
        SITE #

1/1/1964          12:05 AM
  ALARM STATUS REPORT

TANK NO. 1              GAL


       HIGH LIMIT
         ACTIVE
HIGH LIMIT        0.000 IN

       LOW LIMIT
        CLEARED
LOW LIMIT          0.0 GAL

      WATER LIMIT
         ACTIVE
WATER LIMIT       0.000 IN

          LEAK
LEAK LIMIT         2.0 G/H

         THEFT
THEFT LIMIT       10.0 GAL
```

9. ***System Setup Report***

a. Press **RPRT** key
b. Press **UP** or **DN** key until “Setup”
c. Press **ENTER** key
d. Press **1 - 8** for desired tank or **0** for all tanks
e. Press **ENTER** key

10. ***Tank Setup Report***

a. Press RPRT key
b. Press **UP** or **DN** key until “Tank set up”
c. Press **ENTER** key
d. Press **1 - 8** for desired tank or **0** for all tanks
e. Press **ENTER** key

RLM 9000

Automatic Tank Gauging & Electronic Line Leak Detection System

Red Jacket
Marley Pump Co.
9650 Alden Rd.
Lenexa, KS 66215
Tel: 913/541-2985

Evaluator: KWA - 04/02/91

System Description: *The RLM 9000 is a single console unit that incorporates the operational properties of the PPM 4000 and the RLM 5000. Refer to the individual information sheets for additional system description and sample reports.*

Certification: ***TANK GAUGING***
0.2 gph with PD = 100% and PFA = 0%
LINE TEST
3, 0.2, 0.1 gph with PD = 100% and PFA = 0%

Test Period: ***TANK GAUGING***
Min. 3 hrs with tank 50 - 95% full
LINE TEST
3 gph - 1 min
0.2 gph - 10 min
0.1 gph - 2.5 hrs

Limitations: *Refer to individual sheets for PPM 4000 & RLM 5000*

ST 1400/1800

Automatic Tank Gauging & Electronic Line Leak Detection System

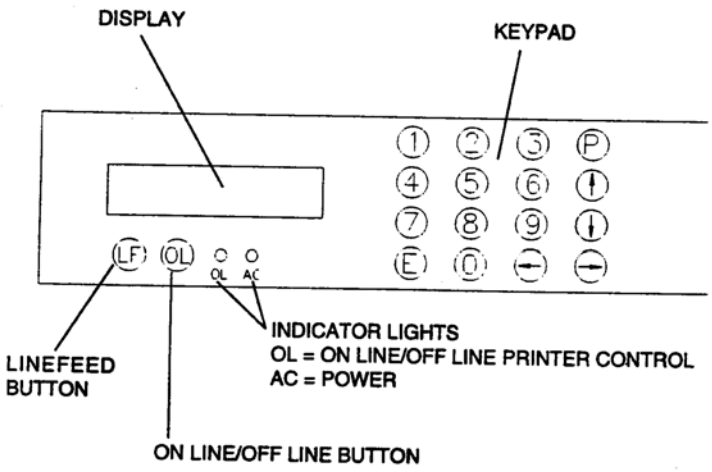
Red Jacket
Marley Pump Co.
9650 Alden Rd.
Lenexa, KS 66215
Tel: 913/541-2985

Evaluator: ADA Technologies, Inc. - 09/30/92

System Description: *The ST1400/1800 controllers are electronic tank gauging devices used for leak detection and inventory management. The controllers can collect level and density data from 4 (ST1400) or 8 (ST1800) ultrasonic inventory sensors and compute various volumetric quantities, correcting all volumes for temperature. The systems have programmable alarm thresholds to alert the operator of various alarm conditions. The system is also capable of storing at least the last 33 events of any particular report. The ADD (accumulative data diagnostics) option adds the capability of continuous leak detection (not 3rd partied). The ST1401/1801 systems add sensor monitoring for interstitial areas, wells and sumps. The ST1400L/1800L add the capability of line leak detection with positive pump shut down.*

Certification:	TANKS: 0.2 & 0.1 gph PIPING: 3, 0.2 & 0.1 gph
Capacity:	TANKS: Max. 18,000 gal PIPING: Max. 55.1 gal
Test Period:	Min. 2.5 hrs with tank 50 - 95% full (0.2 gph) (W/o ADD) 95 - 100% full (0.1 gph)
Limitations:	- No dispensing or delivery during test (w/o ADD) - Not evaluated using manifolded tanks

SAMPLE REPORTS
ST 1800



DISPLAY OPTIONS*

1. *Product Height*
2. *Gross Volume*
3. *Ullage*
4. *Water Height*
5. *Product Temperature*
6. *Report History*
7. *Product Dispensed*
8. *System Status*
9. *Leak Detection*

*Press "E" to get to "SELECT DISPLAY"

CONSOLE DISPLAY

1. ***View Display Options (at SELECT DISPLAY)***
   a. Press desired **display option** keypad #
   b. Press ↑or ↓ key to view remaining tanks

2. ***View History Reports (including leak test)***
   a. Press 6
   b. Press ➔ to scroll to desired report
   c. Press ↑or ↓ key to scroll to "reserved report number"
   d. Press ➔ or ← to view info

3. ***Print Inventory Report***
   (green 'OL' indicator light must be on)
   a. Press **P** key for all tanks
      i. ***For only one feature***, press desired option keypad #
      ii. Press **P**

4. ***Print History Reports***
   (green 'OL' indicator light must be on)
   a. Press **6**
   b. Press ➔ to scroll to desired report
   c. Press **P**
   d. Press ↑or ↓ key to enter "beginning" date
   e. Press **E**
   f. Press ↑ or ↓ key to enter "ending" date
   g. Press **E** to begin printing

```
LINE LEAK TEST        08AUG94 12:08:32

LINE 01

LINE LEAK START TIME      02AUG94 10:56:01
LINE LEAK END TIME        02AUG94 12:08:22
ENDING PRESSURE           9.3 PSI
T: 3599/0008              A01
AIR COUNTER               0
COMPLETE PRECISION TEST

END OF REPORT
```

```
    RED JACKET LEAK DETECTION SYSTEMS
         VERSION RJ1-12  020CT95

SHORT STOP
7647 LEAVENWORTH
KANSAS CITY,KS.
913-788-3091

              LEAK TEST
-----------------------------------------
      29MAY97              01:27:32

TANK 2  UNLEADED PREM  -0.038 GAL/H FAIL
--------------------

ALARM LEAK RATE   0.050 GAL/H
PROBABILITY OF DETECTION 99.9%

PRODUCT HEIGHT            39.54 INCHES
PRODUCT VOLUME          4009.7 GALLONS
LEAK DET START TIME     28MAY97 22:15:59
LEAK DET END TIME       29MAY97 01:27:32
LEAK DET PERIOD         03 HRS 11 MINS
LEAK DET START WATER      0.00 INCHES
LEAK DET END WATER        0.00 INCHES
LAST DELIVERY           26MAY97 16:31:46
LEAK TEST NO  1935
--------------------

-----------------------------------------
              END OF REPORT
```

AUTO∫STIK II & JR

Automatic Tank Gauging & Electronic Line Leak Detection System

EBW
2814 McCracken Ave.
Muskegon, MI 49441
Tel: 616/755-1671

Evaluator: Ken Wilcox Ass. - 08/20/93

System Description: *The AUTO/STIK II and JR. series are electronic monitoring devices capable of tracking inventory, detecting leaks and providing alarm warnings. The systems can also be equipped with a continuous 24-hour leak detection option; however this option does not accumulate data during intermittent still times as most systems do, but continually starts a leak test at still times and ends the leak test only after a 30-minute still time. A leak rate for one test period is calculated by combining still period leak tests through four consecutive days. The AUTO/STIK II can be equipped with the electronic line leak detection option which can monitor 1 to 8 pressurized lines. The AUtO/STIK II is capable of monitoring 1 to 16 tanks for leak detection, 1 to 64 liquid sensors and 1 to 56 relay outputs. The JR series are capable of handling the number of tanks indicated on the model # and are limited to the amount of sensors and relay outputs they provide.*

Certification: 0.1 gph with PD = 98.3% and PFA = 1.7%

Tank Capacity: Max. 15,000 gal **Piping:** 89 gal.

Test Period: Min. 4 hrs with tank 50 - 95% full

Limitations:
- No dispensing or delivery during test (even w/CLD)
- Not evaluated using manifolded tanks
- Not capable of monitoring product lines (JR series)

SAMPLE REPORTS
AUTO∫STIK

1. ***Printing Reports***

   a. Depress **PRINT REPORTS**
   b. Depress desired report or **MORE**
   c. Continue to press **MORE** until desired report
   d. Depress desired report
   e. Depress **ALL** or enter desired tank # (**01**, **02**, etc.)
   f. Depress **PRINT**

2. ***Print Inventory Information (Status Report)***

   a. Depress **PRINT REPORTS**
   b. Depress **STATUS REPORT**
   c. Depress **ALL** or enter desired tank # (**01, 02**, etc.)
   d. Depress **PRINT**

3. ***Print Leak Report***

   a. Depress **PRINT REPORTS**
   b. Depress **MORE**
   c. Depress **LEAK REPORT**
   d. Depress **ALL** or enter desired tank # (**01, 02**, etc.)
   e. Depress **PRINT**

```
--------- LINE LEAK REPORT ---------
      WED MAY 22,96  5:48:19 PM
STATION NAME:
        GENES SERVICE
        SHERMAN
        MUSKEGON MI

        LINE 1

CURRENT STATUS:      NO ERRORS
0.2 GPH MONTHLY PASS:      YES
0.2 GPH TEST HISTORY:
                APR:
                MAR:
                FEB:
                JAN:
                DEC:
                NOV:
LAST 0.2 GPH TEST:       PASS
    TUE MAY 21,96  7:01:52 PM
LAST 0.1 GPH TEST:       PASS
    TUE MAY 21,96 10:04:07 PM
----------------------------
```

```
--------- STATUS REPORT ----------

    WED MAY 22,96  9:49:46 AM

STATION NAME:

TANK 1 PRODUCT:      LEAD FREE

CURRENT STATUS:
  |CNT|   |   |   |   |   |   |

GROSS:                  615.161 gal
NET:                    608.541 gal
FUEL LEVEL:             28.9232 in
WATER LEVEL:             0.6443 in
TEMP:                   76.510 °F
GROSS VTF:              355.857 gal
GROSS ULLAGE:  95%=307.307 gal
----------------------------
```

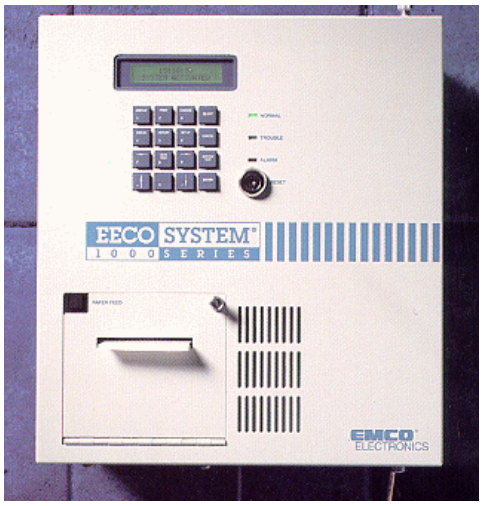
```
---------- AUTO LEAK TEST----------
      WED MAY 22,96  5:47:21 PM
STATION NAME:
      GENES SERVICE
      SHERMAN
      MUSKEGON MI

TANK 1 PRODUCT:       DIESEL

LEAK RATE:       0.009 gal/hr
          PASS 0.2 GPH TEST

PERCENT OF TANK TESTED: 41.1 %
START: SUN MAY 19,96 12:00:02 AM
BEG FUEL LEVEL:     51.5870 in
BEG WATER LEVEL:     0.0357 in
       850.905 gal,  53.04 °F
       850.917 gal,  53.02 °F
       850.928 gal,  53.00 °F
       850.936 gal,  52.98 °F
END:  SUN MAY 19,96  4:09:01 AM
END FUEL LEVEL:     51.5870 in
END WATER LEVEL:     0.0352 in
----------------------------
```

4. ***Print Line Leak Report***

   a. Depress **PRINT REPORTS**
   b. Depress **MORE - MORE - MORE -MORE**
   c. Depress **LINE LEAK REPORT**
   d. Depress **ALL** or enter desired tank # (**01**, **02**, etc.)
   e. Depress **PRINT**

EECO SYSTEM
1000 SERIES

Automatic Tank Gauging



EMCO Electronics
114-300 Mackenan Dr
Cary, NC 27511
Ph# 919/460-6000

Evaluator: Midwest Research Institute - 04/29/94

System Description: *The EECO 1000 functions in the same manner as the EECO 2000, but does not monitor product lines or external sensors. It is strictly a tank management system designed to monitor up to eight tanks. Tank leak tests will start automatically after deliveries or can be programmed to start at a selected time daily, weekly, or monthly. A segmented leak detection (SLD) option is available to provide continuous tank leak detection; however, it is not 3rd party certified.*

Refer to the EECO 2000 information sheets for additional system description and instructions to obtain reports.

Certification: 3.0, 0.2 & 0.1 gph

Tank Capacity: Max. 15,000 gal

Test Period: Min. 1 hrs with tank 50 - 95% full

Limitations:
- Not evaluated using manifolded tanks
- No dispensing or delivery during test
- Does not monitor product lines
- Does not monitor external sensors

EECO SYSTEM
1500 SERIES

Automatic Tank Gauging & Sensor Detection System

EMCO Electronics
114-300 Mackenan Dr
Cary, NC 27511
Ph# 919/460-6000

Evaluator: Midwest Research Institute - 04/29/94

System Description: *The EECO 1500 functions in the same manner as the EECO 2000, but does not monitor product lines electronically. The EECO 1500 system is able to monitor product lines by the use of interstitial sensors. Monitoring sensors can also be used for dispenser pans, sumps and liquid/vapor wells. The EECO 1500 management system is designed to monitor two and four tank systems. Tank leak tests will start automatically after deliveries, or can be programmed to start at a selected time daily, weekly or monthly. A segmented leak detection (SLD) option is available to provide continuous tank leak detection; however, it is not 3rd party certified.*

Refer to the EECO 2000 information sheets for additional system description and instructions to obtain reports.

Certification: 3.0, 0.2 & 0.1 gph

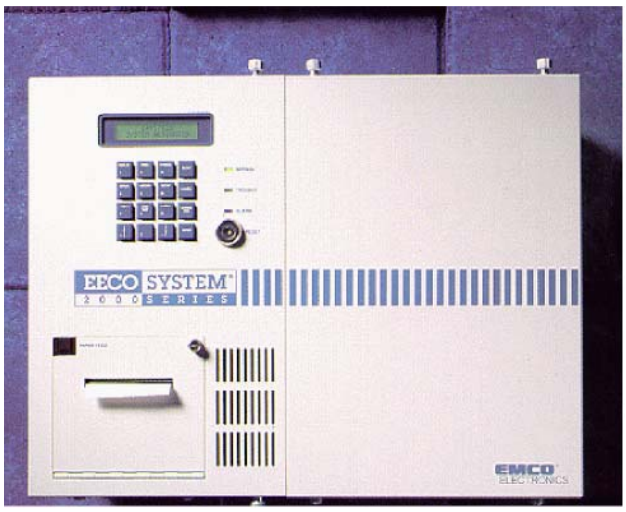
Tank Capacity: Max. 15,000 gal

Test Period: Min. 1 hrs with tank 50 - 95% full

Limitations:
- Not evaluated using manifolded tanks
- No dispensing or delivery during test

EECO SYSTEM
2000 SERIES

Automatic Tank Gauging & Electronic Line Leak Detection System



EMCO Electronics
114-300 Mackenan Dr
Cary, NC 27511
Ph# 919/460-6000

Evaluator: Midwest Research Institute - 04/29/94

System Description: *The EECO 2000 is designed to monitor up to eight tanks, 24 EECO Choice sensors and eight pressurized lines. Tank leak tests will start automatically after deliveries or can be programmed to start at a selected time daily, weekly or monthly. A segmented leak detection (SLD) option is available to provide continuous tank leak detection; however, it is not 3rd party certified. The sensors are designed to detect fuel and water in secondary containment vessels, sumps, dispenser pans, and monitoring wells. When alarm conditions occur, audible or display lights will be activated. The event is then written into the history log. The Line Leak Detector option provides product line leak detection at 3, 0.2 & 0.1 gph. Leaks exceeding the 'pump shutoff' threshold will disable submersible pumps. Product line leak tests can occur automatically or manually*.

Certification: TANKS: 0.2 & 0.1 gph PIPING: 3, 0.2 & 0.1 gph

Tank Capacity: Max. 15,000 gal

Test Period: Min. 1 hrs with tank 50 - 95% full

Limitations:
- Not evaluated using manifolded tanks
- No dispensing or delivery during test
- Must have LLD option for product line testing

SAMPLE REPORTS
ECCO 2000

1. ***View Display Functions***
   (to print reports; press PRINT *prior to the following)*

   a. Press DISPLAY
   b. Press STATUS, HISTORY **or** LEAK TEST
   c. Press ENTER
   e. Press ↓ to scroll thru menu selection
   f. Press ENTER **when desired menu**
   g. Continue to press ↓ for desired submenu
   h. Press ENTER **when desired submenu**
   i. Press CANCEL **to exit menu level**

2. ***Print Inventory Status***
   a. Press [PRINT**] [**STATUS**][**ENTER**]**
   [ENTER**]**

STATION NAME HERE
STREET ADDRESS
CITY, STATE, ZIP
PHONE NUMBER
V22.04

11-07-94 09:15:00

TLM INVENTORY STATUS REPORT:

TANK 1 REGULAR		
PRODUCT LEVEL:	28.02	"
GROSS VOLUME:	2421.79	US GAL
NET VOLUME:	2411.64	US GAL
PRODUCT TEMP:	67.18	°F
ULLAGE (TO 95%):	6819.21	US GAL
WATER LEVEL:	0.06	"
WATER VOLUME:	0.18	US GAL

(repeats for each tank)

3. ***Print Event History***
   a. Press [PRINT**][**HISTORY**]**
   [ENTER**] [↓] [**ENTER**]**

STATION NAME HERE
STREET ADDRESS
CITY, STATE, ZIP
PHONE NUMBER
22.04

11-07-94 09:15:00

EVENT HISTORY
ALL EVENTS

LOCAL SETUP CHANGED
11-07-94 20:48:19

CH 1 REG NL SMP IMO
WATER
11-07-94 20:47:57

AC POWER ON
11-07-94 13:24:14

4. ***Print Tank Leak Test History***
   a. Press [PRINT**] [**LEAK TEST**][↓]**
   [ENTER**][↓][↓][↓][**ENTER**]**

STATION NAME HERE
STREET ADDRESS
CITY, STATE, ZIP
PHONE NUMBER
V22.04

11-07-94 09:15:00

CURRENT TLM LEAK TEST
STATUS:

TANK 1 REG. NL
NOT RUNNING

TANK 2 DIESEL
RUNNING

****

LAST SUCCESSFUL TLM LEAK TEST:

TANK 1 REGULAR

0.2 GPH TEST
11-07-94 02:19:00

PRODUCT LEVEL:	34.63	"
% VOLUME:	42	%
PRODUCT TEMP:	76.97	°F

CALCULATED RATE OF CHANGE:
-0.001
(VOLUME IS INCREASING.)

****

TLM LEAK TEST HISTORY:

TANK 1 REGULAR

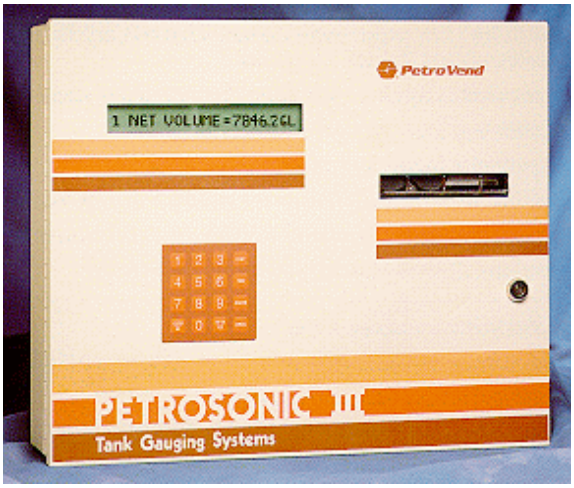
PASSED 0.2 LEAK TESTS
11-07-94 15:20
11-01-94 14:33

****

PETROSONIC III

Automatic Tank Gauging System

Petro Vend
6900 Santa Fe Drive
Hodgkins, IL 60525
Tel: 708/485-4200



Evaluator: Underwriters Laboratories, Inc. - 11/04/94

System Description: *The Petrosonic III is a microprocessor-based system capable of monitoring up to eight probes. The controller interprets probe data, converts the product level measurements into volume measurements and produces reports. The controller records alarms such as low product, high water, overfill and theft. The controller also functions as a leak indicator by continuously watching for extremely small changes in product level. This is not leak testing, but product variances. The Petrosonic III has alarm inputs you can connect to external devices such as hydrocarbon detectors or alarm bells. The system has three modes of operation: privileged, non-privileged and standby. If the system is in the privileged mode, you must have an access code. Default code is HELLO.*

Certification: 0.2 gph with PD = 99.07% and PFA = 0.93%

Tank Capacity: Max. 15,000 gal

Test Period: Min. 4 hrs with tank 50 - 95% full

Limitations:
- No dispensing or delivery during test
- Not evaluated using manifolded tanks
- Not capable of monitoring product lines
- Not capable of continuous monitoring

SAMPLE REPORTS
PETROSONIC III

REPORT NAME	FUNCTION #
Status	1
Inventory	2
Deliverys	3
Variation	4
Alarms	7
Tank Info	8
Tank Leak Test	53

Access #'s for Reports

1	2	3	PR
4	5	6	TM
7	8	9	AC
CL	0	EN	CN

Console Keypad

ALL REPORTS ARE OBTAINED IN THE FOLLOWING MANNER:

1. ***Printing Reports***

   a. Press ACCESS
   b. Press ENTER; **console displays** '**non-privileged**'
   followed by '**display command > 0**'
   c. Enter Access **# for desired report (above)**
   d. Press PRINT
   e. Press ENTER **for report on all tanks**

2. ***Print List of Keypad Commands (Help)***

   a. Press ACCESS
   b. Press ENTER
   c. Press PRINT
   d. Press ENTER

3. ***Abort Command***

   a. Press CANCEL
   b. Press ACCESS

SAMPLE REPORTS
PETROSONIC III

```
  ** PETROSONIC III **
        TANK GAUGE SYSTEMS.
         BY PETRO VEND INC.

           STATUS
      12:07 PM TUE NOV 13,1990
              --------- TANK ---------
      ALARM      1  2  3  4  5  6  7  8
     OVERFLOW    2  2* .
  LOW PRODUCT    .  .  .
   HIGH WATER    1* 1* 1*
  TEMPERATURE    .  .  .
   MISSED MEAS   1* 1* .
LEAK INDICATED   1  .  .
        THEFT    .  .  6
     DELIVERY    1  2  1
         SALE    2  .  1
ACCNTING PERIOD  .  .  .
TIMED LEAK TEST  .  .  .

     POWER FAILURE   5
   PRINTER FAILURE   1
          EXTERNAL   .
   SAVED INVENTORY   2
          SCHEDULE   3

6 ACTIVE FLAGS, 34 STORED MESSAGES,
397 FREE BLOCKS, SYSTEM OPEN
```

Status Report

* Active Flag (alarm condition)

```
  ** PETROSONIC III **
        TANK GAUGE SYSTEMS.
         BY PETRO VEND INC.

           INVENTORY
      12:24 PM TUE NOV 13,1990
====== TANK 4  DIESEL
8603.2 GL NET CORRECTED PRODUCT VOLUME.
8605.6 GL NET CORRECTED TANK VOLUME.
8586.9 GL GROSS MEASURED TANK VOLUME.
1413.1 GL VOLUME LEFT IN TANK.
 76.90 IN PRODUCT LEVEL.
  56.3 F  AVERAGE FUEL LEVEL.
   0.4 IN WATER LEVEL
```

Inventory Report

```
  ** PETROSONIC III **
        TANK GAUGE SYSTEMS.
         BY PETRO VEND INC.

           MESSAGES
      12:24 PM WED NOV 14,1990

DELIVERY
======= TANK 4  DIESEL
          D E L I V E R Y
          D E L I V E R Y
  S T A R T   M E A S U R E M E N T
      10:17 AM WED NOV 14,1990
5079.3 GL NET CORRECTED PRODUCT VOLUME.
5093.5 GL NET CORRECTED TANK VOLUME.
5083.6 GL GROSS MEASURED TANK VOLUME.
4916.4 GL VOLUME LEFT IN TANK.
 48.63 IN PRODUCT LEVEL.
  56.3 F  AVERAGE FUEL TEMPERATURE.
   0.9 IN WATER LEVEL.
     E N D   M E A S U R E M E N T
       10:43 AM WED NOV 14,1990
*       O V E R F L O W        *
*     H I G H   W A T E R      *
9965.5 GL NET CORRECTED PRODUCT VOLUME.
9989.6 GL NET CORRECTED TANK VOLUME.
9974.3 GL GROSS MEASURED TANK VOLUME.
  25.7 GL VOLUME LEFT IN TANK.
 94.73 IN PRODUCT LEVEL.
  57.1 F  AVERAGE FUEL TEMPERATURE.
   1.2 IN WATER LEVEL.
     D E L I V E R Y   V O L U M E
4896.1 GL NET CORRECTED TANK VOLUME.
4890.7 GL GROSS MEASURED TANK VOLUME.
  57.9 F  ESTIMATED DELIVERY TEMPERATURE.
```

Delivery Report

SAMPLE REPORTS
PETROSONIC III

Leak Test Report
(Leak Test Report is a subset of Messages Report)

```
  **PETROSONIC III **
        TANK GAUGE SYSTEMS.
        BY PETRO VEND, INC.

           MESSAGES
     12:24 PM  THU NOV 15, 1990

 TIMED LEAK TEST
 ======== TANK 4  DIESEL
      TIMED  LEAK  TEST
     START  MEASUREMENT
       12:00 AM THU NOV 15,1990
5453.1 GL NET CORRECTED VOLUME.
5455.5 GL GROSS MEASURED VOLUME.
5446.6 GL VOLUME LEFT IN TANK.
 51.37 IN PRODUCT LEVEL
  56.9 F  AVERAGE FUEL TEMPERATURE
   0.4 IN WATER LEVEL
       END  MEASUREMENT
5453.2 GL NET CORRECTED VOLUME.
5455.6 GL GROSS MEASURED VOLUME.
4554.7 GL VOLUME LEFT IN TANK
 51.36 IN PRODUCT LEVEL
  56.0 F  AVERAGE FUEL TEMPERATURE
   0.4 IN WATER LEVEL
         LEAK  RATE
0.016 GL/HOUR NET CORRECTED LEAK RATE.
  -0.9 F TEMPERATURE CHANGE
        FOR 4.0 HOURS
        THRESHOLD = 0.05 GL/HOUR
TEST PASSED
```

Alarms Report

```
  **  PETROSONIC  III **
         TANK GAUGE SYSTEMS.
          BY PETRO VEND INC.

            MESSAGES
         1:06 PM TUE NOV 13,1990
ALARMS
======== TANK 4  DIESEL
        WORST  CASE
*         OVERFLOW          *
9965.5 GL NET CORRECTED PRODUCT VOLUME.
9989.6 GL NET CORRECTED TANK VOLUME.
9974.3 GL GROSSED MEASURED TANK VOLUME.
  25.7 GL VOLUME LEFT IN TANK.
 94.73 IN PRODUCT LEVEL.
  57.1 F  AVERAGE FUEL TEMPERATURE.
  23.5 GL GROSS WATER VOLUME.
   1.2 IN WATER LEVEL.
        HIGH  WATER
START 10:22 AM TUE NOV 13,1990
END   11:14 AM TUE NOV 13,1990
        WORST  CASE
*       HIGH  WATER         *
 6254.2 GL NET CORRECTED PRODUCT VOLUME.
 6284.0 GL NET CORRECTED TANK VOLUME.
 6275.1 GL GROSS MEASURED TANK VOLUME.
   25.7 GL VOLUME LEFT IN TANK.
  57.86 IN PRODUCT LEVEL.
   57.3 F  AVERAGE FUEL TEMPERATURE.
   29.8 GL GROSS WATER VOLUME.
    1.4 IN WATER LEVEL.
*    LEAK  INDICATED     *
START     1:00 AM TUE NOV 13,1990
  END     2:00 AM TUE NOV 13,1990
 1.00 GAL  PER HOUR  AVERAGE LEAK RATE
======== TANK 5
        MISSED  MEAS
 START  POWER UP
   END  IN PROGRESS
 MISSED 528 MEASUREMENTS
======== SYSTEM
       POWER  FAILURE
            POWER FAILURE
 START   9:22 AM THU NOV  1,1990
   END  11:14 AM THU NOV  1,1990
   PRINTER  FAILURE
            PAPER OUT
 START   8:57 AM TUE NOV 13,1990
   END   9:01 AM TUE NOV 13,1990
```

SiteSentinel

Model II

Automatic Tank Gauging System

PETRO VEND
6900 Santa Fe Drive
Hodgkins, IL 60525
Ph# 708/485-4200

Evaluator: Underwriters Lab., Inc. - 11/04/94

System Description: *The SiteSentinel is a microprocessor-based system capable of monitoring probes and sensors. Each SiteSentinel system has one controller to manage operations and can be upgraded with modules to incorporate additional probe and sensor capability. Up to eight modules can be connected for a total of 128 probes and sensors. Inventory and system reports are available anytime and can be scheduled to print automatically. Built-in sound and light alarms can signal any system event. The SiteSentinel has three modes of operation: privileged, non-privileged and restricted. If the system is in the privileged mode, you must have the password. The default password is HELLO.*

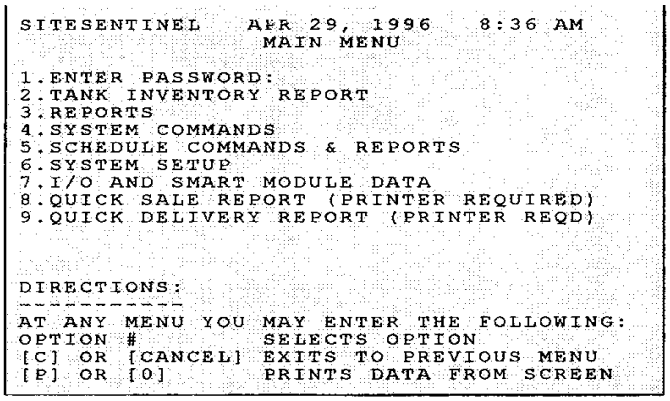
Certification: 0.1 & 0.2 gph

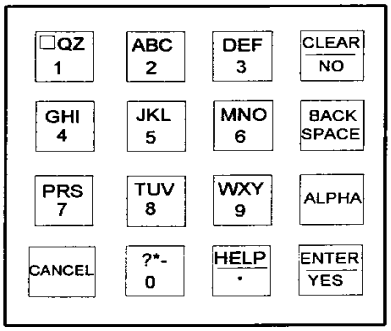
Tank Capacity: Max. 15,000 gal

Test Period: Min. 2 hrs (0.2 gph) with tank 50 - 95% full
Min. 4 hrs (0.1 gph) with tank 90% full

Limitations:
- No dispensing or delivery during test
- Not evaluated using manifolded tanks
- Not capable of monitoring product lines
- Not capable of continuous monitoring

SAMPLE REPORTS
Site Sentinel





Main Menu Display

1. ***Go to Main Menu***
   a. Press **CLEAR/NO** till Main Menu
   b. Press **CLEAR/NO** to scroll sub-menus

2. ***If password is necessary***

   a. Press **1**
   b. Enter password with console letter or numbers. (Try **HELLO**)
   c. Press **ENTER**

3. ***Tank Inventory Report***

   a. Press **2**
   b. Press **0** to print report on all tanks

4. ***Alarms in Progress***

   a. Press **3** then **6**
   b. Press **0** to print current alarms

Console Keypad

5. ***Alarm History***

   a. Press **3** then **7**
   b. Press 0 to print alarm history

6. ***Leak Test Report***

   a. Press **3** then **10** then **8**
   b. Press **0** to print

Soil Sentry
Liquid 330

Double-Walled UST
Monitoring System

Arizona Instrument - AZI
4114 E. Wood St
Phoenix, AZ 85040
Tel: 602/731-3434

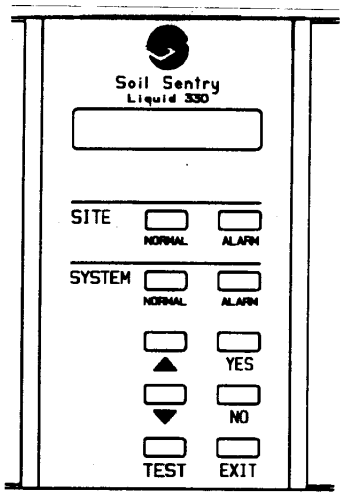
Evaluator: **Ken Wilcox Ass. - 01/08/93**

System Description: *The Soil Sentry Liquid 330 uses optical sensing technology to monitor double-contained storage tanks and piping. The system utilizes up to 10 optical sensing probes which continuously monitor annular spaces in tanks and piping. Probes can also be installed in the tanks to provide high and low-level alarms. The Liquid 330 uses a WET/DRY probe to distinguish between normally DRY or WET conditions. A discriminating probe can be used to determine whether the liquid is water or product. All event conditions (alarms) are stored and can later be recalled. The system is capable of storing 350 lines of information.*

Detector:
Output type:	qualitative
Sampling frequency:	continuous
Operating principle:	refraction

Applicability: Unleaded and synthetic gas, diesel fuel, n-hexane, jet-A fuel, toluene, xylene(s) and water

SAMPLE REPORTS
Liquid 330



Console

Display Options

1. View Menu Options?
2. View Current Status?
3. View Print Options?
4. Make Setup Changes?
5. Diagnostics Options?

1. ***View or Print Current Status***
   a. Press **YES** or **NO** until "View Current Status?"
   b. Press ↑ or ↓ until desired information
   c. Press **YES** to download information
   d. Press **EXIT** to leave routine

```
LIQUID 330 CURRENT STATUS
05-MAR-91 12:33

Site Name
Site Address
City, State, Zip
Site Comments

Controller: OK
Calibration: 2.54 Volts, OK

Probe  1: 2.64 Volts, Normal
Probe  2: Inactive
Probe  3: 2.64 Volts, Normal
Probe  4: Inactive
Probe  5: Inactive
Probe  6: 2.64 Volts, Normal
Probe  7: Inactive
Probe  8: Inactive
Probe  9: 2.64 Volts, Normal
Probe 10: Inactive
```

2. ***View or Print History***
   a. Press **YES** or **NO** until "View Print Options?"
   b. Press ↑ or ↓ until "Print History?"
   c. Press **YES** to download information
   d. Press **EXIT** to leave routine

```
LIQUID 330 PAST SIGNIFICANT EVENTS
16-APR-91 13:53

16-04-91 13:37  Event: Operate/Setup
    Power: ON
16-04-91 13:37  Event: Site Alarm
    Probe 10 ALARM
16-04-91 13:38  Event: Operate/Setup
    Site Alarm Cleared
16-04-91 13:50  Event: Operate/Setup
    Setup Menu Entered
16-04-91 13:52  Event: Operate/Setup
    Setup Menu Entered
16-04-91 13:52  Event: System Alarm
    EVENT MEMORY
16-04-91 13:52  Event: Operate/Setup
    System Alarm Cleared
End of Significant Events
```

Soil Sentry
Twelve - X

Vapor Monitoring System

Arizona Instrument - AZI
4114 E Wood St
Phoenix, AZ 85040
Tel: 602/731-3434

Evaluator: Ken Wilcox Ass. - 04/17/91

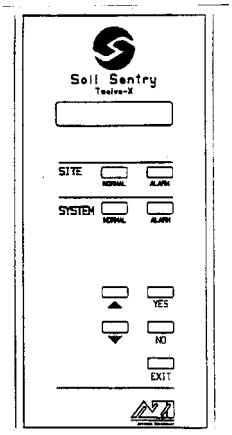
System Description: *The Soil Sentry Twelve-X is an "aspirated vapor" monitoring system. It is designed to analyze the vapor concentration of Total Organic Hydrocarbons (TOH) found in the soil and backfill around motor fuel tanks. The system searches for leaks by drawing air samples from up to 12 underground locations and electronically analyzing those samples for the vapor of leaking hydrocarbon materials. The system sequentially draws air samples from each active vapor sampling point three times a day. If a vapor level above the adjustable alarm level is identified over three successive sampling cycles, or if a dangerously high vapor level is identified during any one cycle, the site alarm is triggered and a record is made of the day, cycle period, identification of the high-vapor sampling point and the measured vapor level.*

Detector: Output type: quantitative
Sampling frequency: continuous
Operating principle: metal oxide semiconductor

Applicability: Unleaded and synthetic gas, diesel fuel, n-hexane, JP 4 & 5 jet fuel, toluene, xylene(s)

SAMPLE REPORTS

Twelve – X



Console

Display Options

1. ***View Menu Options?***
2. ***System Status?***
3. ***View Site Levels?***
4. ***View Print Options?***
5. ***Operate/Setup Options?***
6. ***Diagnostics Options?***

1. ***View Site Levels***
   a. Press **YES** or **NO** until "View Site Levels?"
   b. Press ↑ or ↓ until desired information
   c. Press **EXIT** to leave routine

2. ***View or Print Alarm History***
   a. Press **YES** or **NO** until "View Print Options?"
   b. Press ↑ or ↓ until Past Signif(icant) Events
   c. Press **YES** to download information
   d. Press **EXIT** to leave routine

Arizona Instrument Corp.
1100 E. University
Tempe, Arizona 85281

14-MAR-90 09:00

Well	Vapor(ppm)	Press(In.H20)	Alarm
00	1200	-052	3500 PPM
01	0010	-050	3500 PPM
02	0010	-050	3500 PPM
03	0010	-050	3500 PPM
04	0010	-050	3500 PPM
05	0010	-050	3500 PPM
06	0010	-050	3500 PPM
07	0010	-050	3500 PPM
08	0010	-050	3500 PPM
09	0010	-050	3500 PPM
10	0010	-050	3500 PPM
11	0010	-050	3500 PPM
12	0010	-050	3500 PPM

3. ***View or Print Past Vapor Levels***
   a. Press **YES** or **NO** until "View Print Options?"
   b. Press ↑ or ↓ until "Past Vapor/Pressure?"
   c. Press **YES** to download information
   d. Press **EXIT** to leave routine

Arizona Instrument Corp.
1100 E. University
Tempe, Arizona 85281

09-MAR-90 00:00

Well	Vapor(ppm)	Press(In.H20)
00	0010	-049
00	0010	-049
00	0010	-049

09-MAR-90 08:00

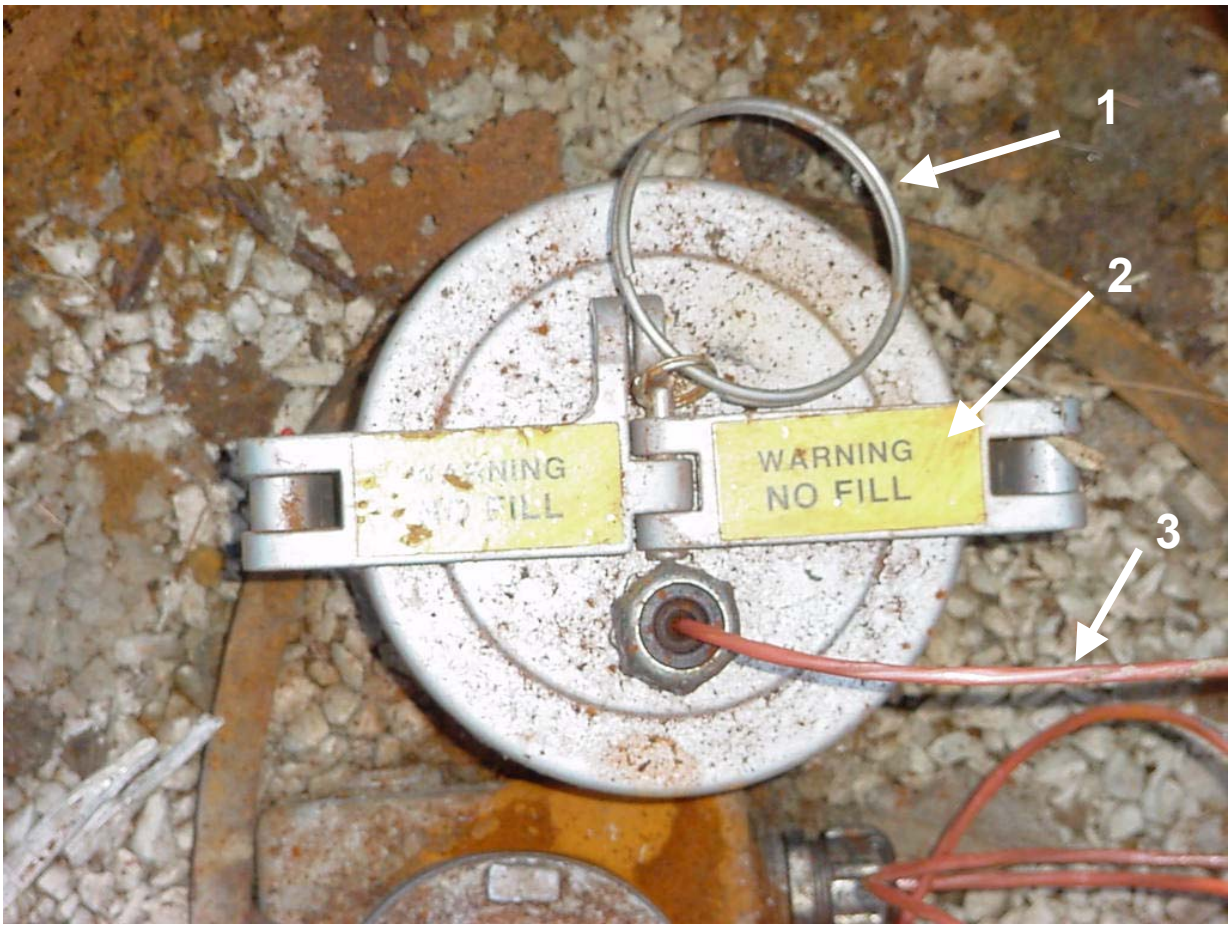
Well	Vapor(ppm)	Press(In.H20)
00	0010	-050
01	0010	-050
02	0010	-049
03	0010	-049
04	0010	-049
05	0010	-049
06	0010	-049
07	0010	-049
08	0010	-049
09	0010	-049
10	0010	-049
11	0010	-049
12	0010	-049

09-MAR-90 16:00

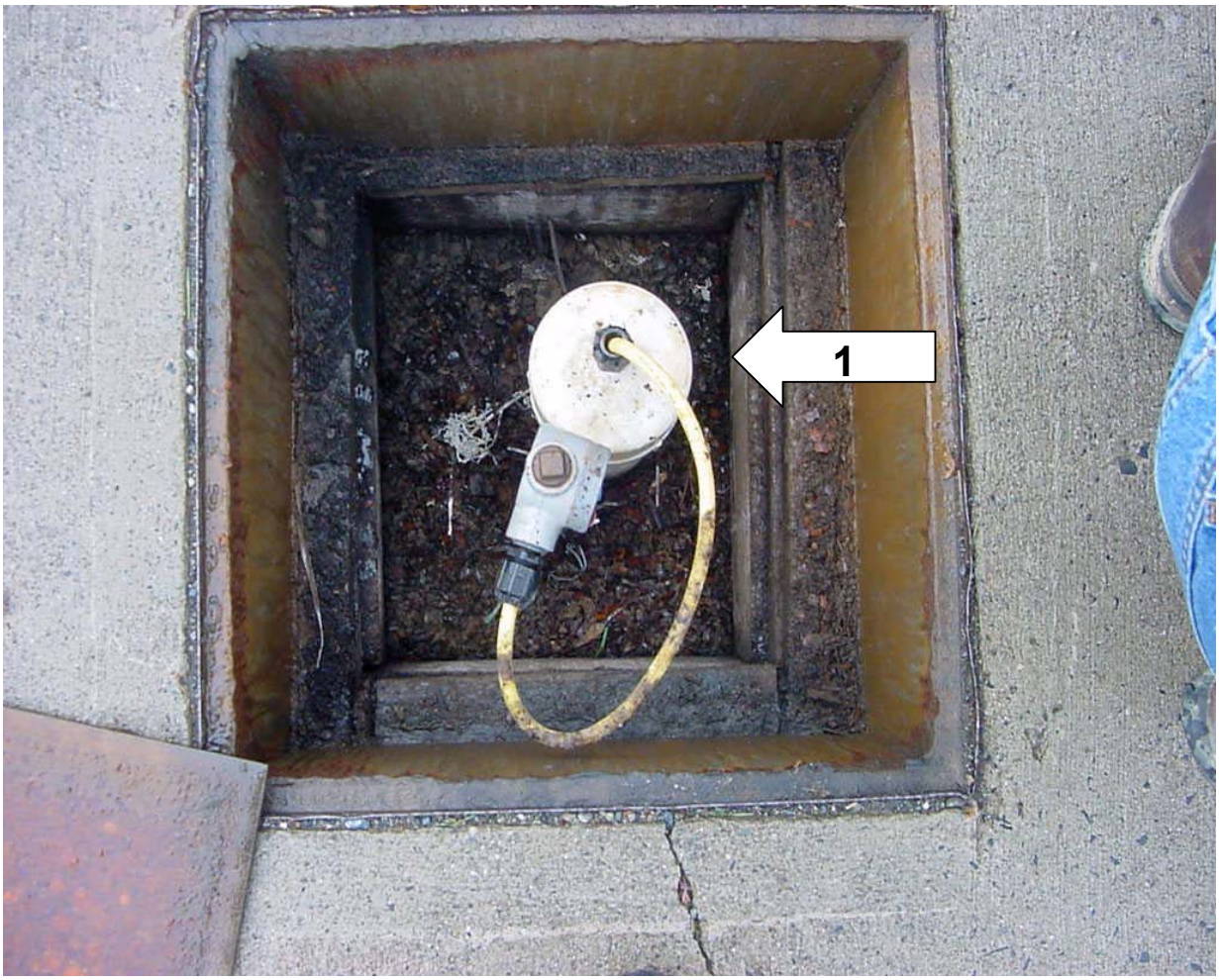
Well	Vapor(ppm)	Press(In.H20)
00	0010	-050
01	0010	-050
02	0010	-049
03	0010	-049
04	0010	-049
05	0010	-049
06	0010	-049
07	0010	-049
08	0010	-049
09	0010	-049
10	0010	-049
11	0010	-049
12	0010	-049

ATG Probes

This is an ATG in-tank probe that is located directly above the tank. The probe measures the product level and can detect minute changes in these levels. This allows the probe to be used in conjunction with an ATG panel for tank leak detection. The locking pull ring (1) is very common as well as the yellow warning label (2) “No Fill”. The wire (3) to the ATG panel is also present. Inspection Significance: Determine if the owner or operator uses the probe for leak detection or just for inventory record keeping for delivery schedules. *See definition: ATG probe.*

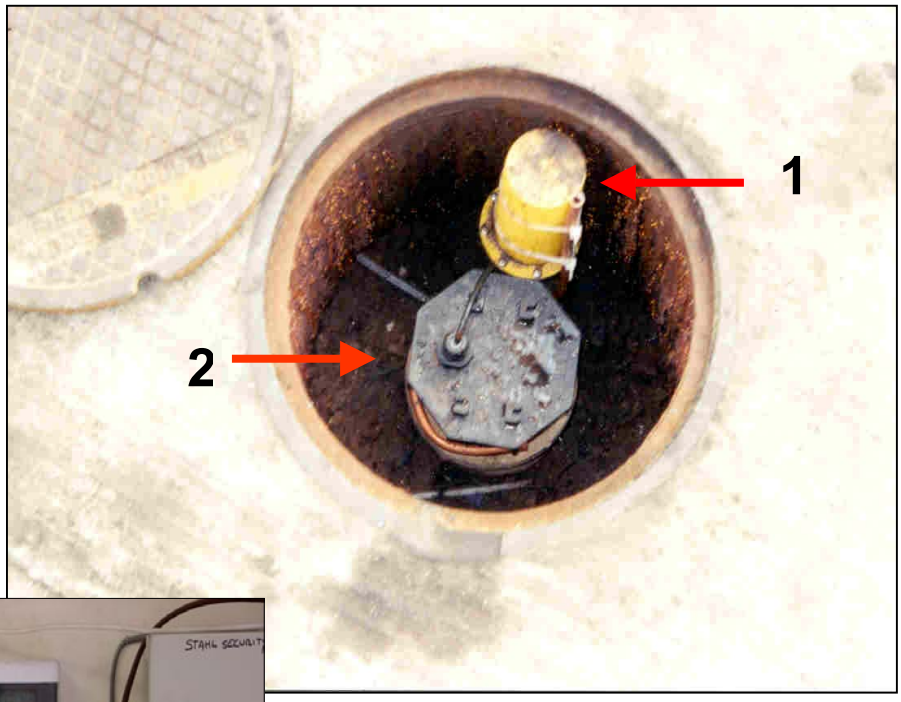


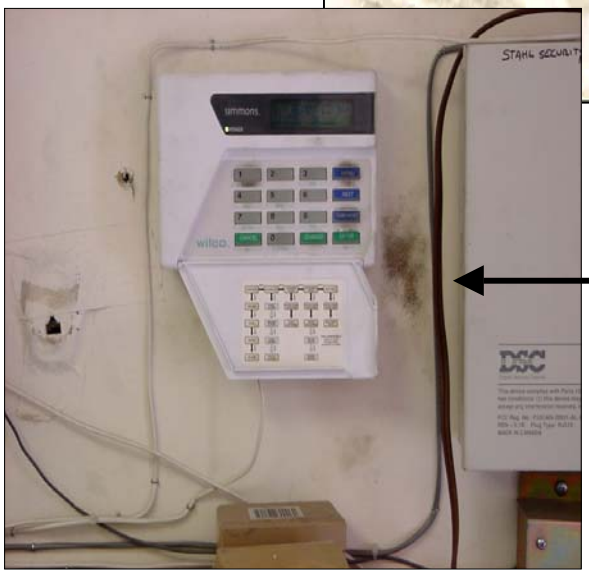
Another style of ATG probe. The cap (1) is white PVC plastic and can be confused with an interstitial tank probe. The ATG probes are usually located at the center of the tank, while the interstitial probe is usually (but not always) located at a tank end. Inspection Significance: Determine if the probe is functioning by having the owner or operator run a system test in your presence. *See definitions: ATG probe and interstitial.*



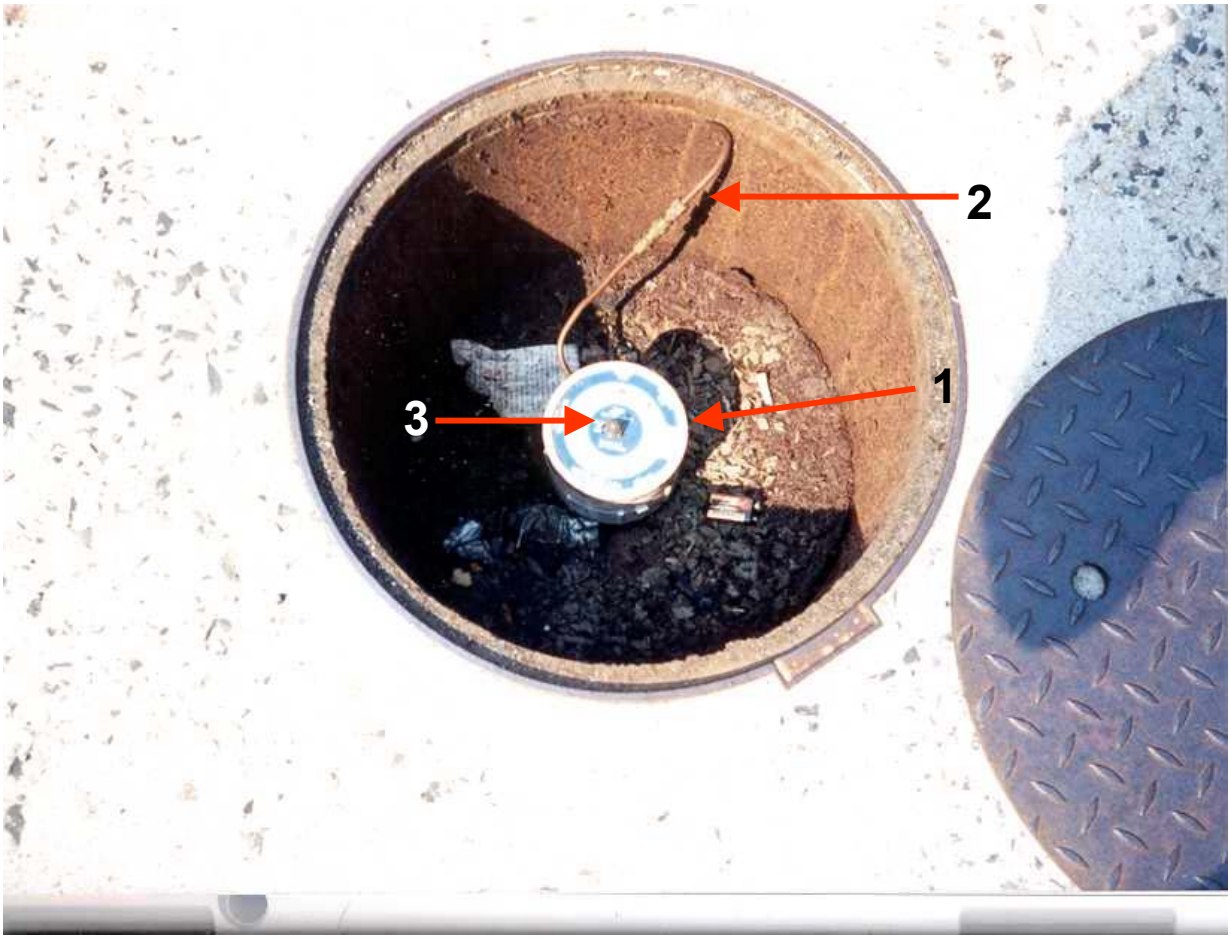
This sump does not contain an STP, and no product lines are present, but an ATG probe riser (1) is present. Note the electrical junction box (4). Although difficult to see, a manway cover (2) is present which may mean the tank has been lined. Lining of the UST is suspected since manways are not usually installed to house an ATG probe riser. Also note the steel sump cover (3) with a lifting ring. Inspection Significance: Confirm if lining is the method of corrosion protection for the USTs, when the lining was installed, and if an inspection of the lining is due. *See definitions: ATG probe, manway and lining.*

This is a Wilco Simmons wireless tank gauging unit that is used to measure minute changes in the contents of an UST. These readings generate statistical inventory reconciliation (SIR) data to satisfy the requirements for tank and line-leak detection. The transmitter and battery are in the yellow housing (1). A radar unit is in the tank riser (2). This unit measures the product level and transmits it to the receiver in the office (inset photo). Inspection Significance: Review the monthly SIR reports. Failed or indeterminate results must be corrected by the next month's monitoring schedule. Failed results must be followed up by results of a suspected release investigation. If SIR failure or indeterminate results are common and are not the results of an actual release, the owner or operator must be required to change to a method of release detection monitoring that is reliable for the site conditions. *See definitions: SIR, Wilco Simmons, riser.*



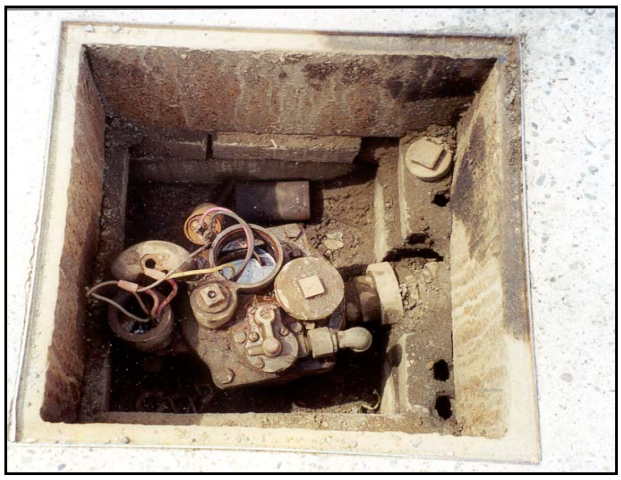


This is a tank field vapor well fitted with an electronic vapor detector (1). The test button (3) can be pressed to activate the red warning light which indicates if hydrocarbon vapors are present in the well. The unit is battery powered (a nine-volt battery is in the sump). Item (2) is a vent for the well. Inspection Significance: The owner or operator is required to press the test button once a month and record the results of this test in a journal for leak-detection documentation. *See definitions: tank- field well and vapor well.*

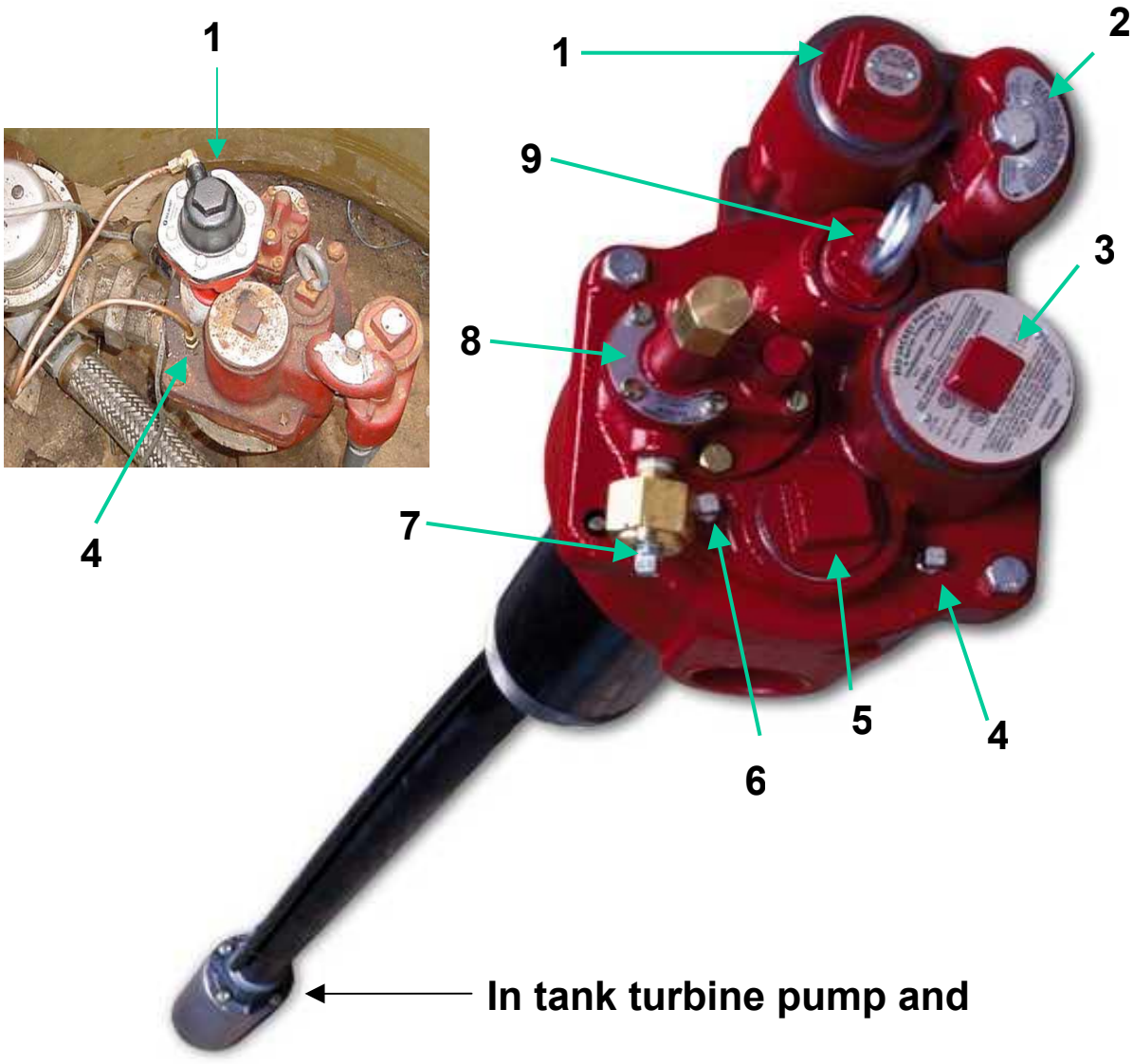


STP Sumps

- **Pressure transducers**
  - **Swiftcheck®**
- **Wireless line-leak detectors**
- **Line-leak detectors**
- **Test boots**
- **Liquid sensors**



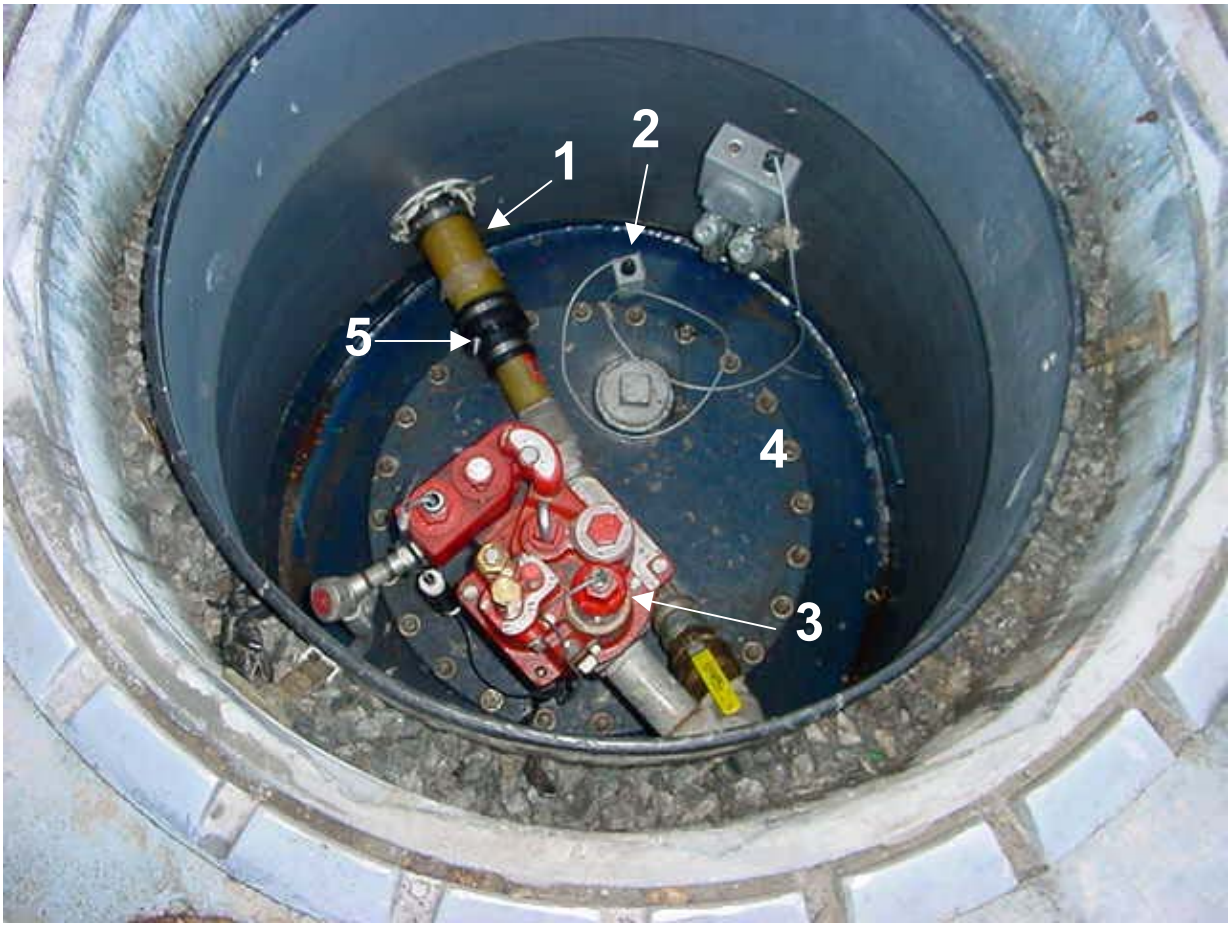
A Marley (Red Jacket) “Extracta®,” the most commonly seen turbine at gas stations. The following items are identified as: (1) wiring connection housing, (2) wiring conduit housing, (3) condenser/capacitor housing, (4) tank test port, (5) line leak detector port, (6) line test port, (7) siphon check valve (puts vacuum on manifold when STP is running), (8) functional element, (9) lift ring. Of important note: If a vented line-leak detector (10) is present (see inset photo), it must be vented to the tank test port 4 not to ports 6 or 7 - or it will not function properly, and the owner or operator will not be performing the required 3 gph continuous test for pressurized systems.



These units, which are made by Marley Pump (Red Jacket), are primarily for fuel dispensing, but can also perform line-leak detection tests capable of detecting a 3 gallon per hour leak at 10 psi line pressure within 1 hour, and continuous monitoring at 0.1 and 0.2 gph. The CPT (constant pressure turbine) indicates that they actually control the turbine speed. If several dispensers are operating at one time, the line pressure will drop which slows the rate at which fuel can be dispensed. These control units monitor line pressure and when a pressure drop is encountered, the frequency is increased to the turbine pump, allowing an increase in fuel flow. Since they monitor line pressure, they also will do the required line-leak testing. Inspection Significance: The owner or operator must be able to verify that the CPT unit is being used for line-leak detection if the owner or operator makes that claim. A printout from a printer connected to the unit should be available or, if the CPT is equipped with a CP Assist function, it can communicate with an ATG panel to provide a printout. The printout will register a “Pass” or “Fail” for each line it is monitoring. The CPT will also alarm on the panel with 3 flashing red lights and shut down the turbine if a line leak is detected. Look for these at high traffic/large volume stations such as truck stops. *See definitions: CPT, Red Jacket, STP and Marley.*

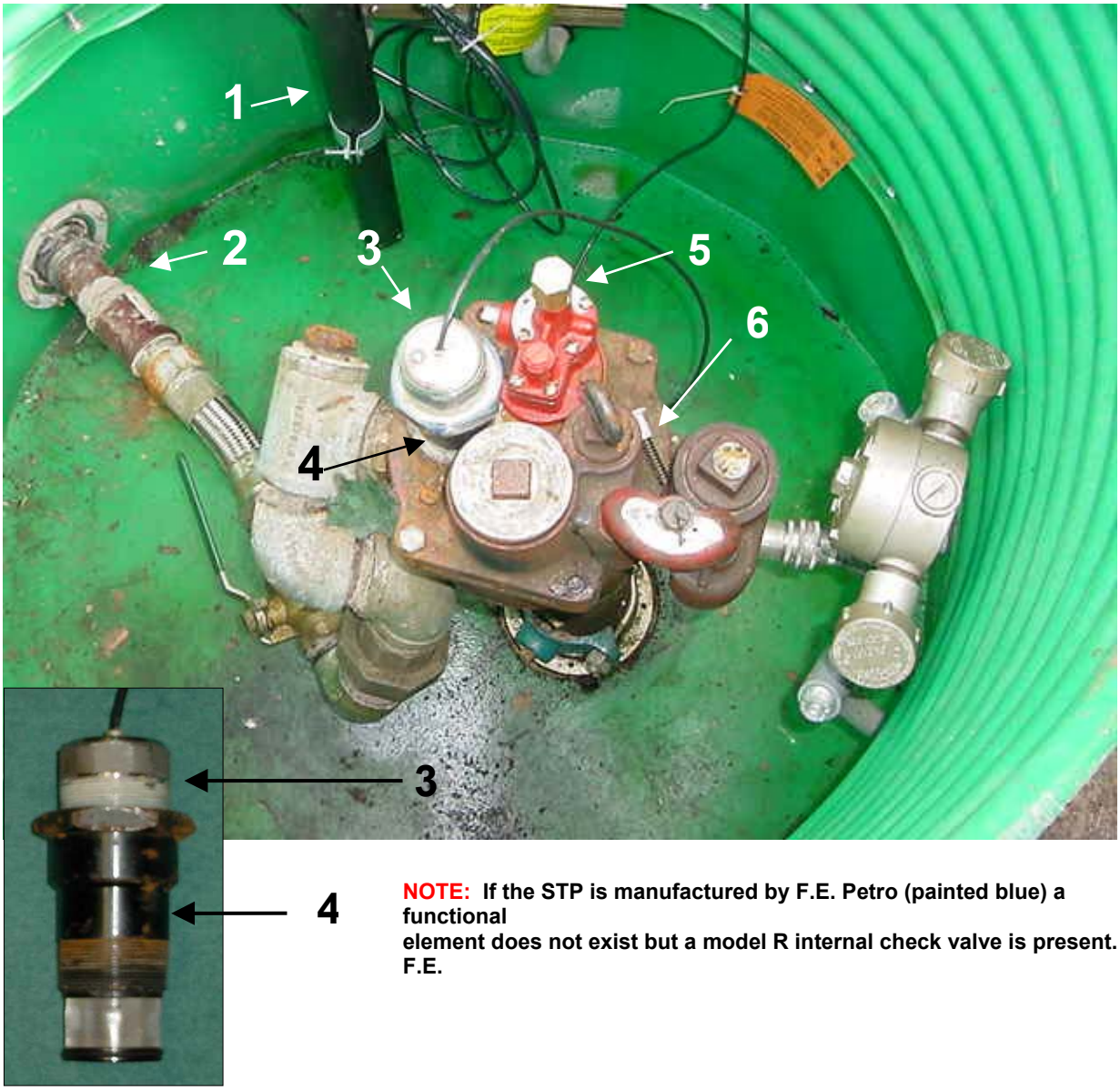
The STP is a “Red Jacket®” Quantum STP. The pressure transducer (1) serves two purposes: 1) It controls the speed of the turbine motor. If several cars are being filled, the transducer allows the pump to speed up to match the demand. 2) When the STP is off, the transducer performs line-leak detection. It tests to 0.1, 0.2 and 3 gph. Inspection Significance: Verify the method of UST leak detection and piping construction, and document that the pressure transducer has been checked in accordance with the manufacturer’s recommended schedule. *See definitions: accumulator, STP, Pressure Transducer.*

Another view of a “Red Jacket®” Quantum STP. The double-wall fiberglass line (1) is monitored by a liquid sensor (2) and a pressure transducer (3). The pressure transducer is capable of detecting line leaks of .1, .2 and 3 gph which eliminates the need for a mechanical LLD. Note the manway (4) which suggests a lined tank. The test boot (5) must be loose which will allow a leak from the piping to drain back to the sump to be detected by the liquid sensor (2). Inspection Significance: Verify the method of UST leak detection and piping construction and document that the pressure transducer and sump sensor have been checked in accordance with the manufacturer’s recommended schedule. Ensure the boot clamps are loose. *See definitions: Test Boot, CPT, STP, Liquid Sensor, Pressure Transducer.*



This site is using a pressure transducer (1) to monitor the lines for leaks. It is capable of detecting leaks of .1 gph, .2 gph and 3 gph. The electrical junction box (2) connects the pressure transducer to the ATG panel. An LLD at location (3) is not required. Inspection Significance: Confirm that the unit has been tested in accordance with the manufacturer's specifications to ensure it is functioning properly. Verify line construction type. *See definitions: pressure transducer and LLD.*

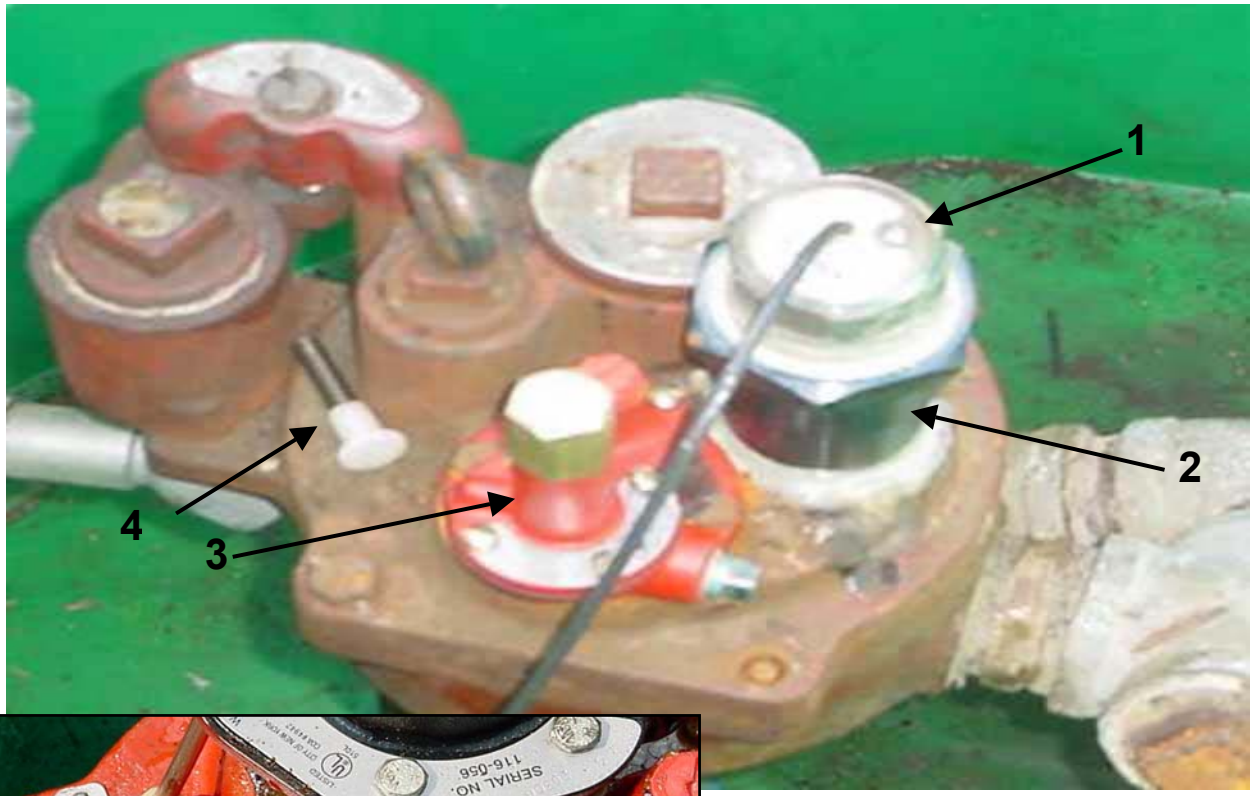
A typical Exxon STP sump that has the following equipment: liquid sensor (1), single wall piping (2), a Veeder-Root pressure transducer (3) and the required SwiftCheck® (functions as a check valve, see 4). Inspection Significance: Make sure the SwiftCheck® (4) is present if the station is using a Marley (Red Jacket) turbine pump (see inset photo for close up view). If the SwiftCheck® is not present, the pressure transducer (3) is not capable of performing monthly line-leak detection (.2 gph). It can only perform the function of an automatic line-leak detector (3 gph). See next photograph for further information regarding the SwiftCheck®. Also, the functional element (5) must be disabled when using the Veeder-Root pressure transducer. In this photo the installation contractor has left the spring and check valve of the functional element (6) on top of the STP as evidence that the unit was disabled. Since single-wall piping is used, the liquid sensor is only monitoring the STP for leaks. Verify line construction type. *See definitions: liquid sensor, ATG, STP sump, Simplicity, Swift Check, LLD and pressure transducer.*

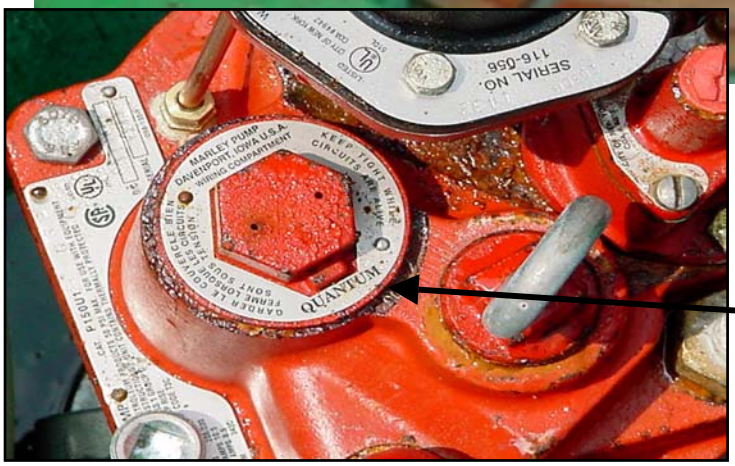


NOTE: If the STP is manufactured by F.E. Petro (painted blue) a functional element does not exist but a model R internal check valve is present. F.E.

This picture shows a Veeder Root pressure transducer installed on a STP. This STP is manufactured by F.E. Petro and typically painted blue. F.E. Petro STPs do not have a functional element but rely on a model “R” internal check valve to maintain line pressure. Inspection Significance: F.E. Petro STPs do not require the use of a SwiftCheck® with the Veeder Root pressure transducer to perform line leak test rates of 0.1 and 0.2 gph because this internal check valve supercedes the use of the SwiftCheck®. Furthermore, the model “R” check valve does not require disabling when combined with a Veeder Root pressure transducer.

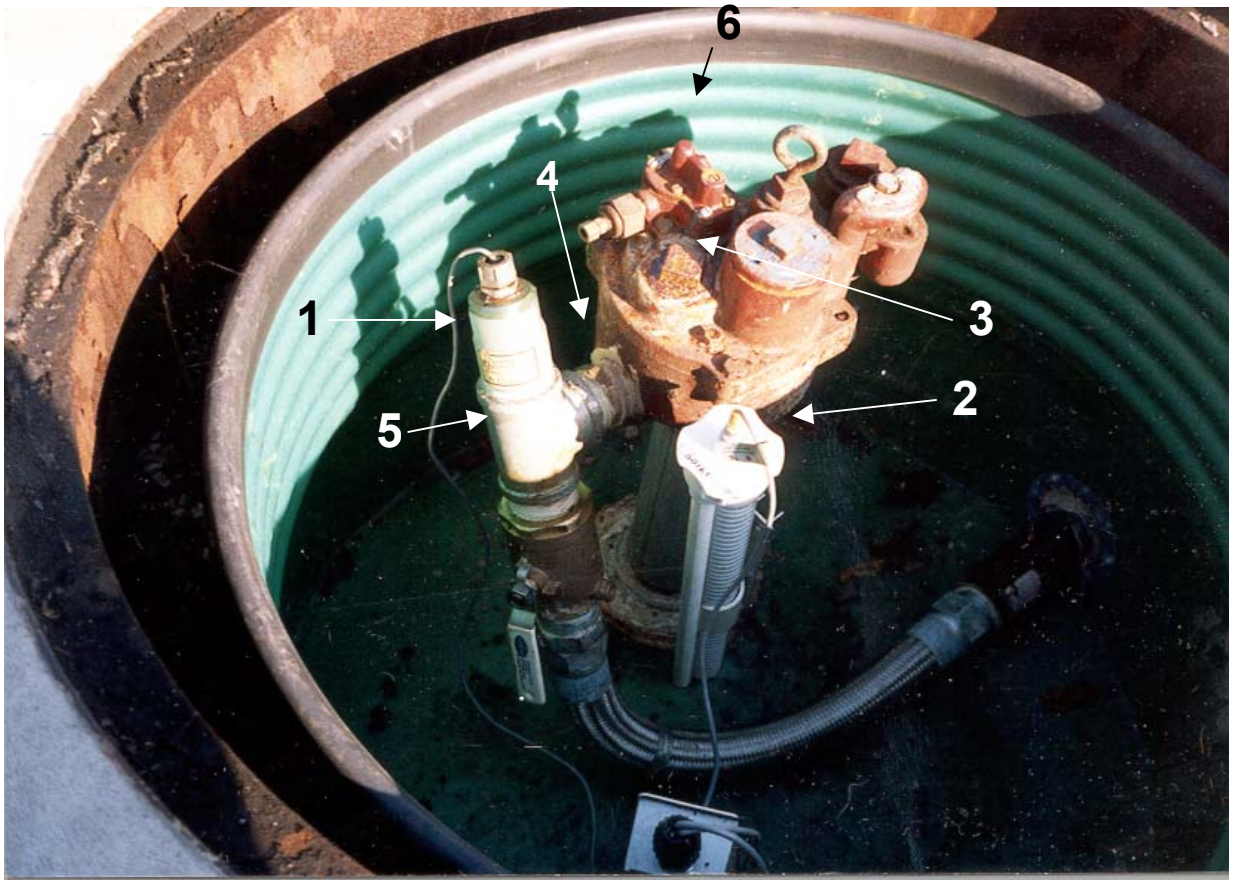
This is a typical Veeder-Root pressure transducer (1) which is capable of monitoring the product line leaks at a rate of .1, .2 and 3 gph. It is mounted where the mechanical Line Leak Detector (LLD) is usually located. The LLD in this case is not needed for leak detection because the pressure transducer is present. This unit is almost always present at Exxon/Mobil sites when a Simplicity unit is monitoring the tanks and lines. Inspection Significance: Unless the STP is a "Red Jacket" Quantum or CPT (identification labels may be found on the STP, see inset photo) the black steel SwiftCheck® riser (2) must be installed to allow the pressure transducer to detect line leaks as low as 0.1 and 0.2 gph. Note the functional element (3) must be disabled by removing the spring and piston (4). Ask the owner or operator to verify this. If the SwiftCheck® is not present, the pressure transducer can only test to 3 gph, which does not meet the required .2 gph monthly leak detection rate. This may be acceptable if an alternate monthly means of monitoring the line is used. *See definitions: ATG probe, pressure transducers, CPT, Quantum, SwiftCheck® and Simplicity*



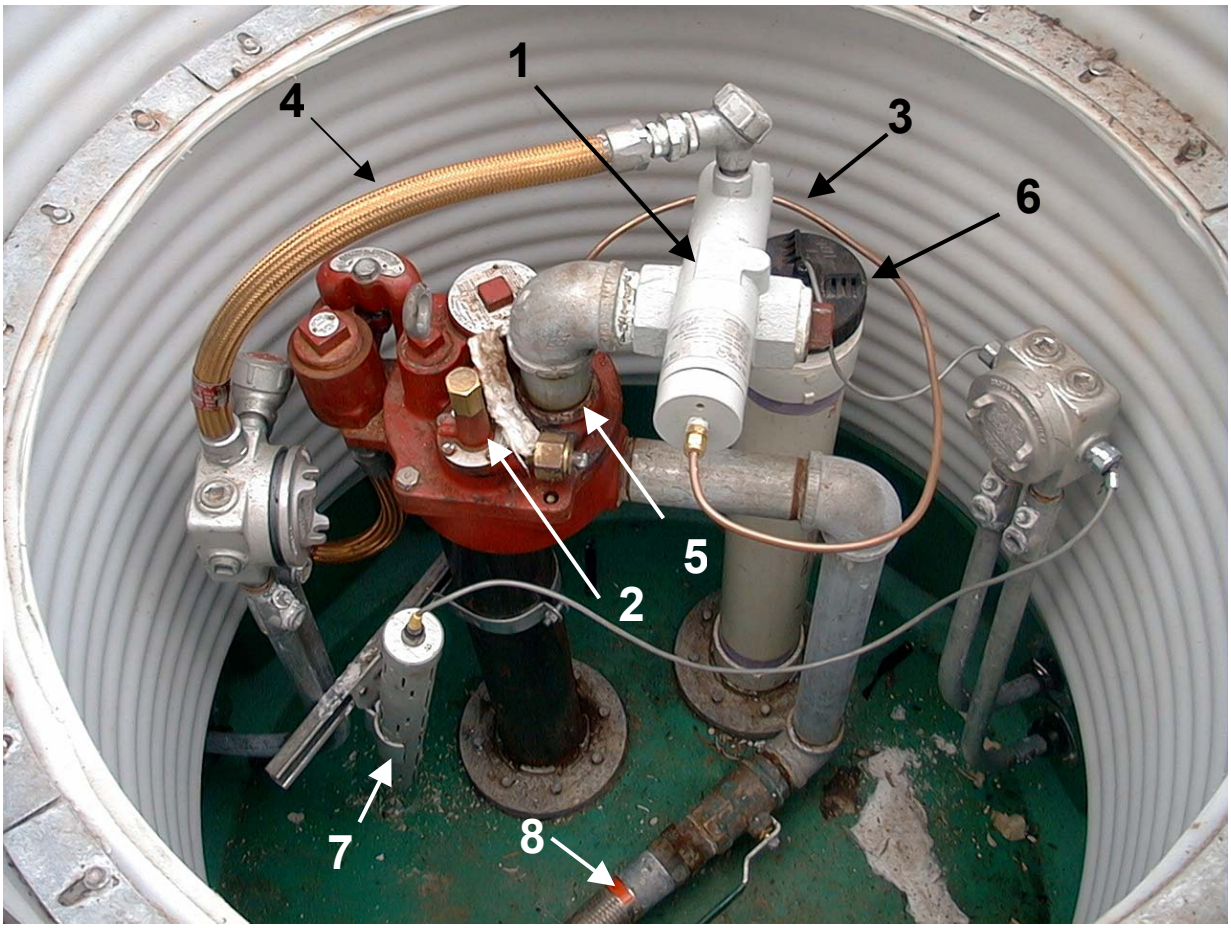


A close-up view of a Quantum STP. Note the label (5) designating the model of the STP .

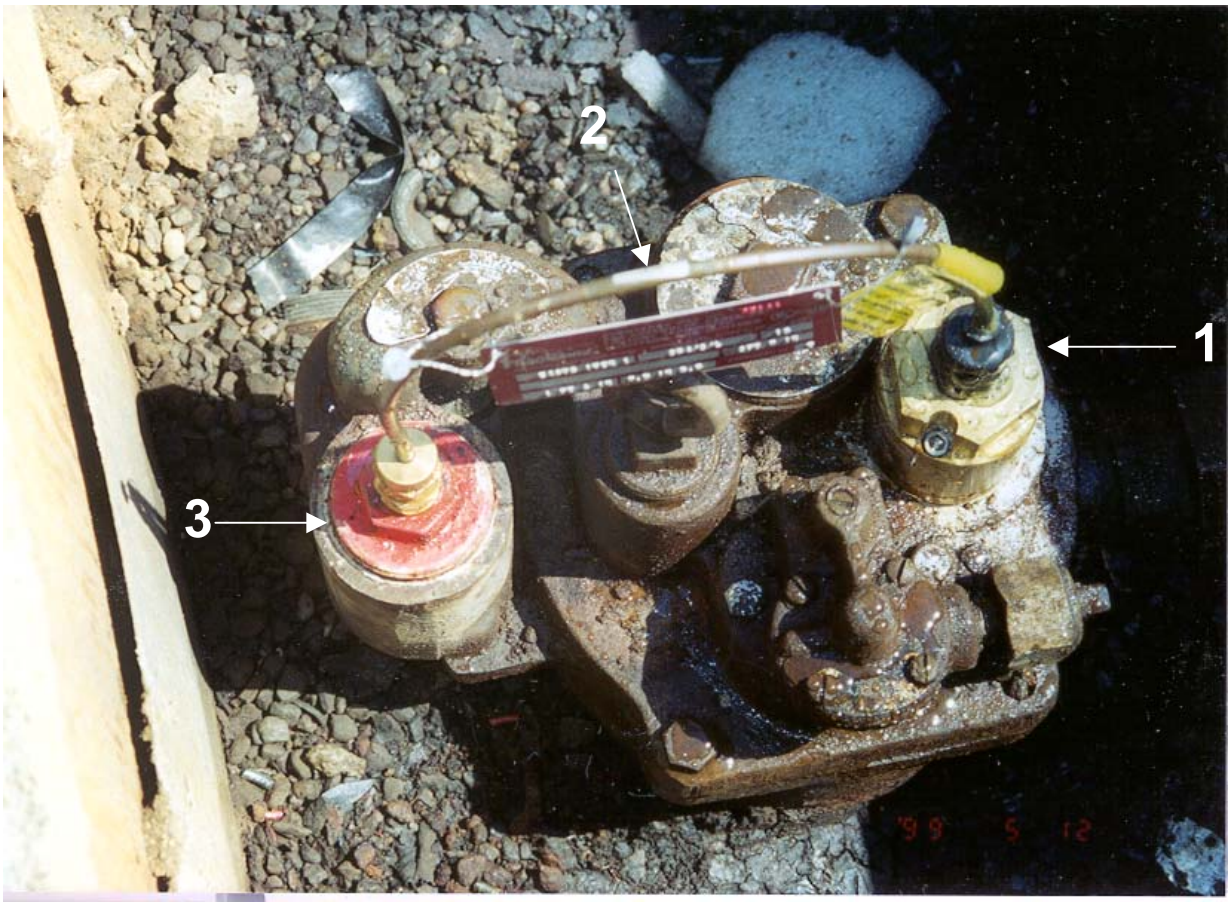
This STP sump is monitored with a Veeder-Root pressure transducer (PLLD) (1), commonly used with the Simplicity system. Since the pressure transducer can detect leaks of .1, .2 and 3 gph, a mechanical LLD is not fitted to the STP LLD port (3). The STP sump is also monitored by a liquid sensor (2); however, at many sites, the product piping is single wall; therefore, the liquid sensor is only used to detect leaks from the STP, and not used for line-leak detection. Inspection Significance: Confirm that an in-line check valve (4) is present just before the tee fitting (5). If this Veeder-Root check valve is not present, the PLLD is only capable of detecting a leak in excess of 3 gph and the owner or operator must also perform monthly line-leak detection or an annual line tightness test. With the Veeder-Root pressure transducer the functional element (6) must be disabled by removing the spring and check valve in order for the pressure transducer to function properly. *See definitions: liquid sensor, pressure transducer, PLLD and Simplicity.*



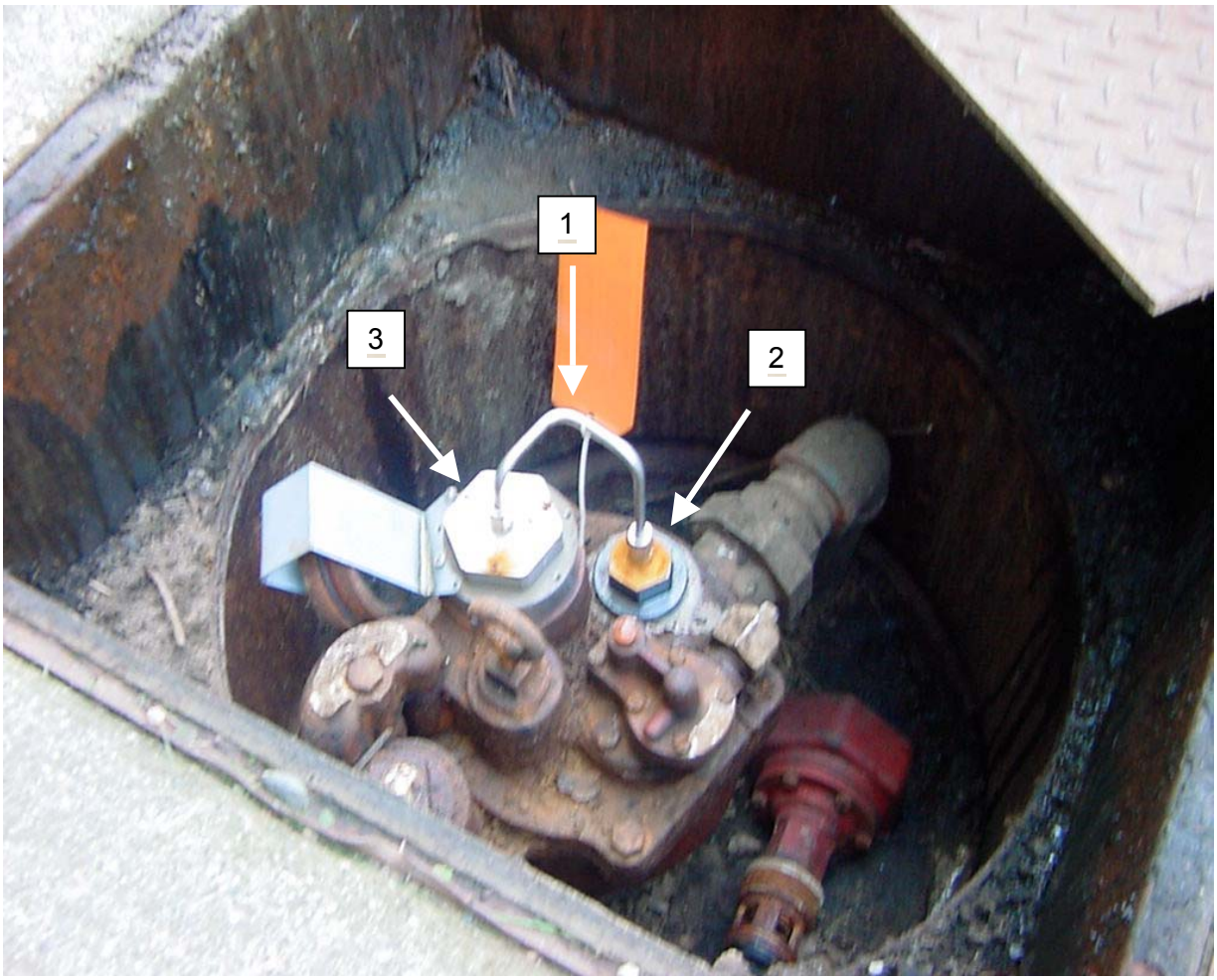
An Emco® Electronics Line Leak Detector Model Q0011-002 (1) which is capable of detecting a line leak of 0.1, 0.2 and 3 gph. Therefore, a separate automatic line leak detector is not required. Also of note are the ATG probe (6) and the liquid sump sensor (7). Inspection Significance: When installed on a “Red Jacket” STP (this example), the STP must be equipped with a functional element (2). Note: the copper vent line (3) from the Emco® sensor to the tank test-port on the STP. This vent must be present for the unit to function on any type of STP. The high voltage electrical conduit (4) connects the power supply for the STP to the pressure transducer. Note: Model Q0011-002 (shown) must be installed in the STP LLD Port (5). Model Q0011-001, which looks like the Q0011-002 in appearance, must be installed in the pressurized product line (8). Determine which model is present during your inspection! .



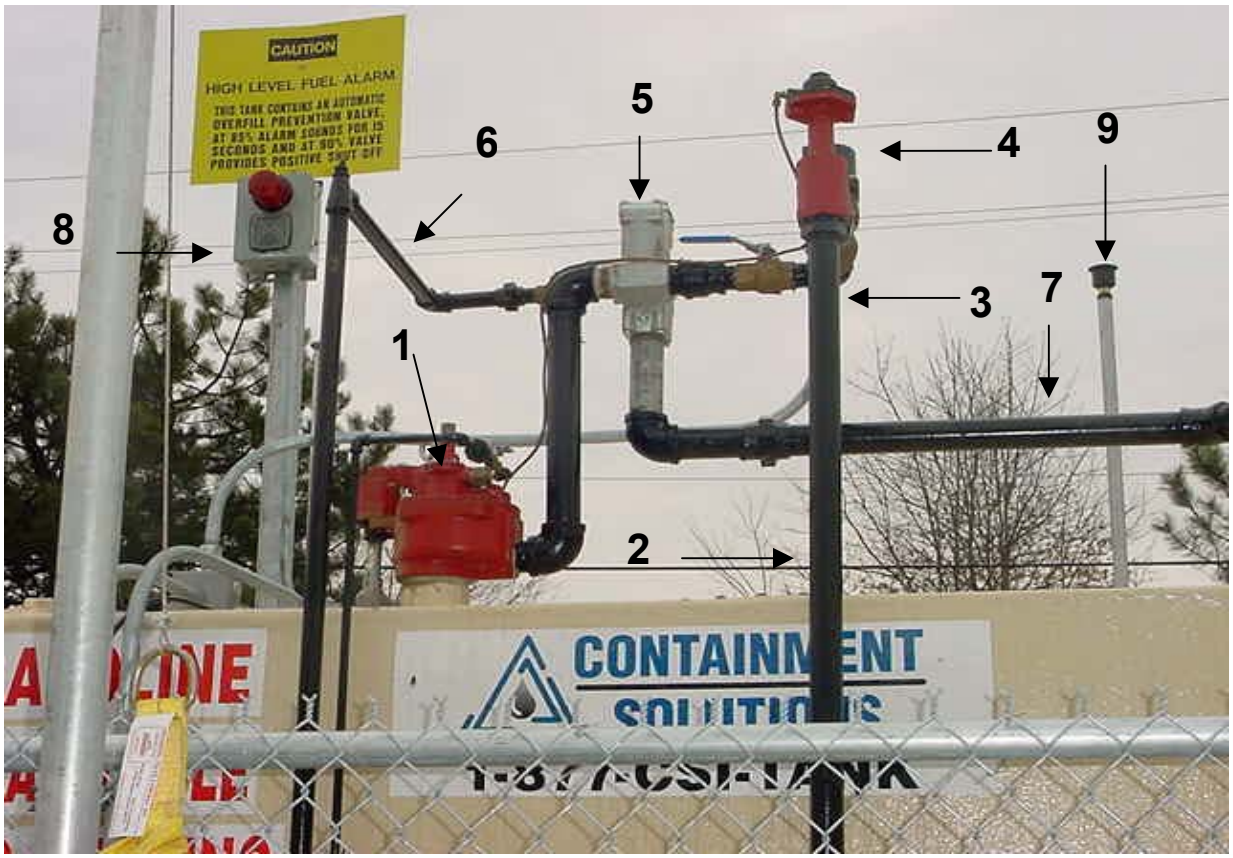
An example of a wireless line leak detector (WLLD); this unit is manufactured by Incon. A pressure sensor (1) monitors the STP output line pressure. Note: a mechanical line-leak detector is not required. A wire in a shielded housing (2) connects the pressure sensor to the switch (3) located in the wiring harness housing. A drop in line pressure from a leak prevents current from flowing to the STP motor, thereby stopping additional product loss. This WLLD can display a warning or alarm on the ATG panel by multiplexing through the 220 Volt AC that runs the turbine motor. The unit is capable of detecting a .1, .2 and 3 gph leak. Inspection Significance: Look for records that the unit has been tested in accordance with the manufacturer's schedule. *See definitions: WLLD, LLD, ATG and STP.*



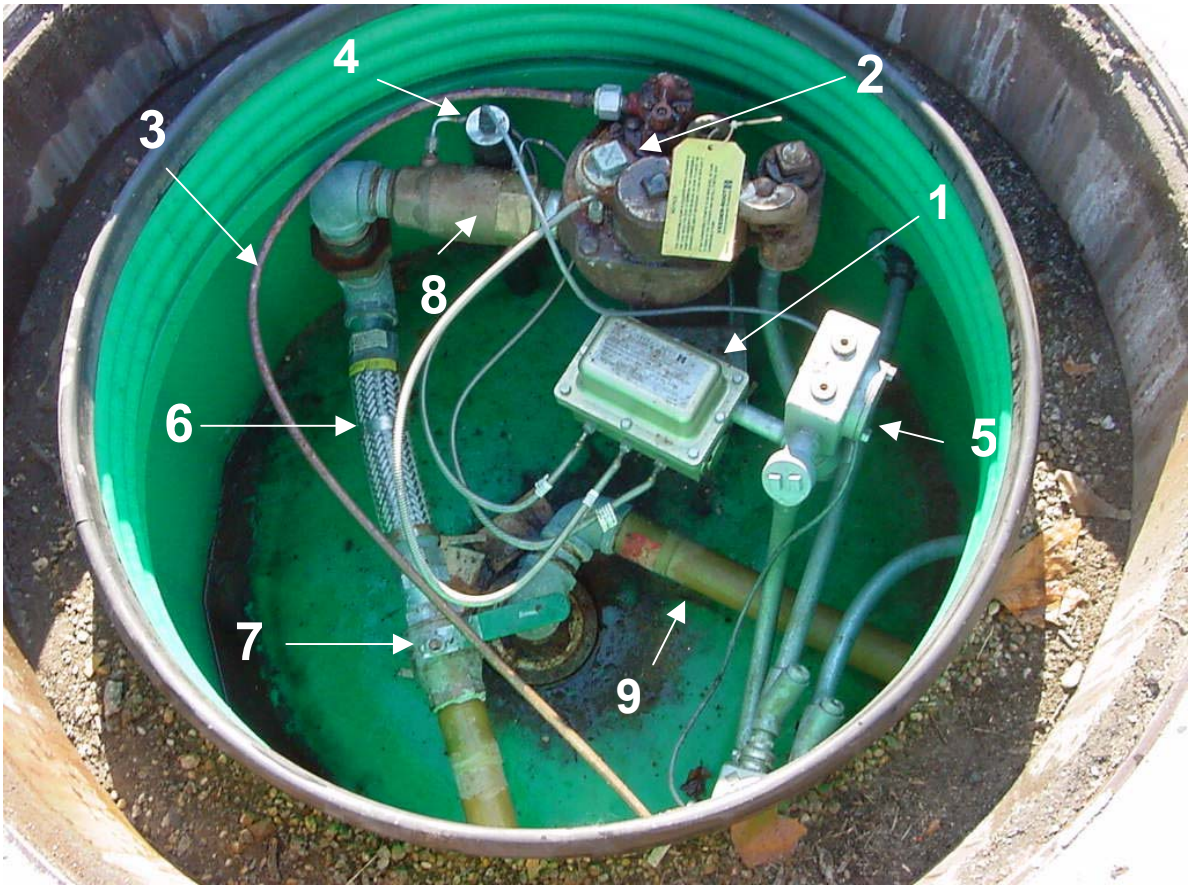
The facility is using a Veeder-Root WLLD for line monitoring (1). The pressure sensor and check valve at (2) is located where the LLD would usually be installed. An electrical switch (3) is connected to the capacitor. If (2) detects a loss of line pressure, (3) does not allow the capacitor to charge, thereby preventing the STP from pumping product. This unit can detect leak rates of .1, .2 and 3 gph if the check valve at (2) is present. If the check valve is not present, the unit is only capable of detecting a 3 gph leak rate. Inspection Significance: The WLLD conducts the line monitoring. Although this sump seems out of compliance, the only compliance aspect of concern in this sump is the method of line-leak detection and the line construction details for corrosion protection requirements. Look for turbine leaks since a product-tight sump is not present. Note: a product-tight sump is not a requirement under federal or state rule. If the check valve at (2) is not present, determine the method on monthly line leak detection being used at the site. In this case, because a product-tight sump is not present, a leaking STP should be reported to LUST and Emergency Response. *See definitions: liquid sensor, WLLD, LLD, STP, interstitial and capacitor.*



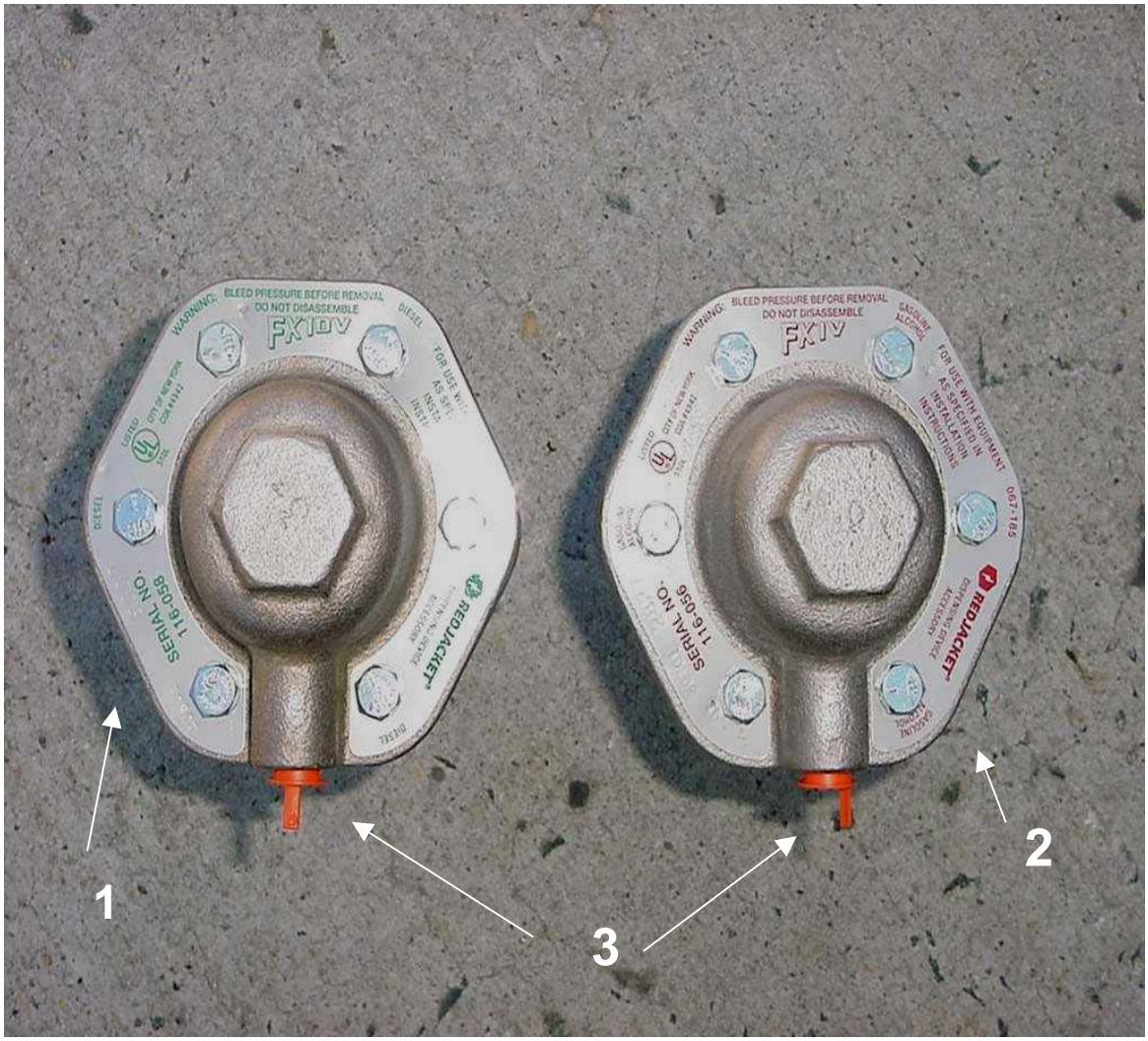
Although this is an above ground tank, there are several items present that are typically found in STP sumps for pressurized UST systems. The turbine is to the left (1) and pumps fuel to the product line (2) which then is connected to the dispenser (not shown). The facility is using a pressure transducer (3) for line-leak detection, and the LLD (4) is also fitted to detect leaks over 3 gph. Since the system is above ground, the Stage II vapor recovery system (not required in Iowa) uses a Healy Mini-Jet (5) to pull the vapors from the car through the vapor recovery line (6). Note: the vapor recovery line (6) connects to the back side of the Healy Mini-Jet not visible in the photo. As gasoline is pumped from the turbine is passes through the Healy Mini-Jet (5) to the dispenser line (2). The gasoline passing through the Healy Mini-Jet causes a fan turbine in the Healy to spin, creating a vacuum on line (6) As the recovered vapors move through the Healy Mini-Jet, they are mixed with some of the gasoline pumped from the turbine and returned to the tank via line .7 Note the horn/light unit (8) for overfill prevention and the vent pipe (9). *See definitions: Vent pipe, Healy, LLD, turbine, Stage II and pressure transducer.*



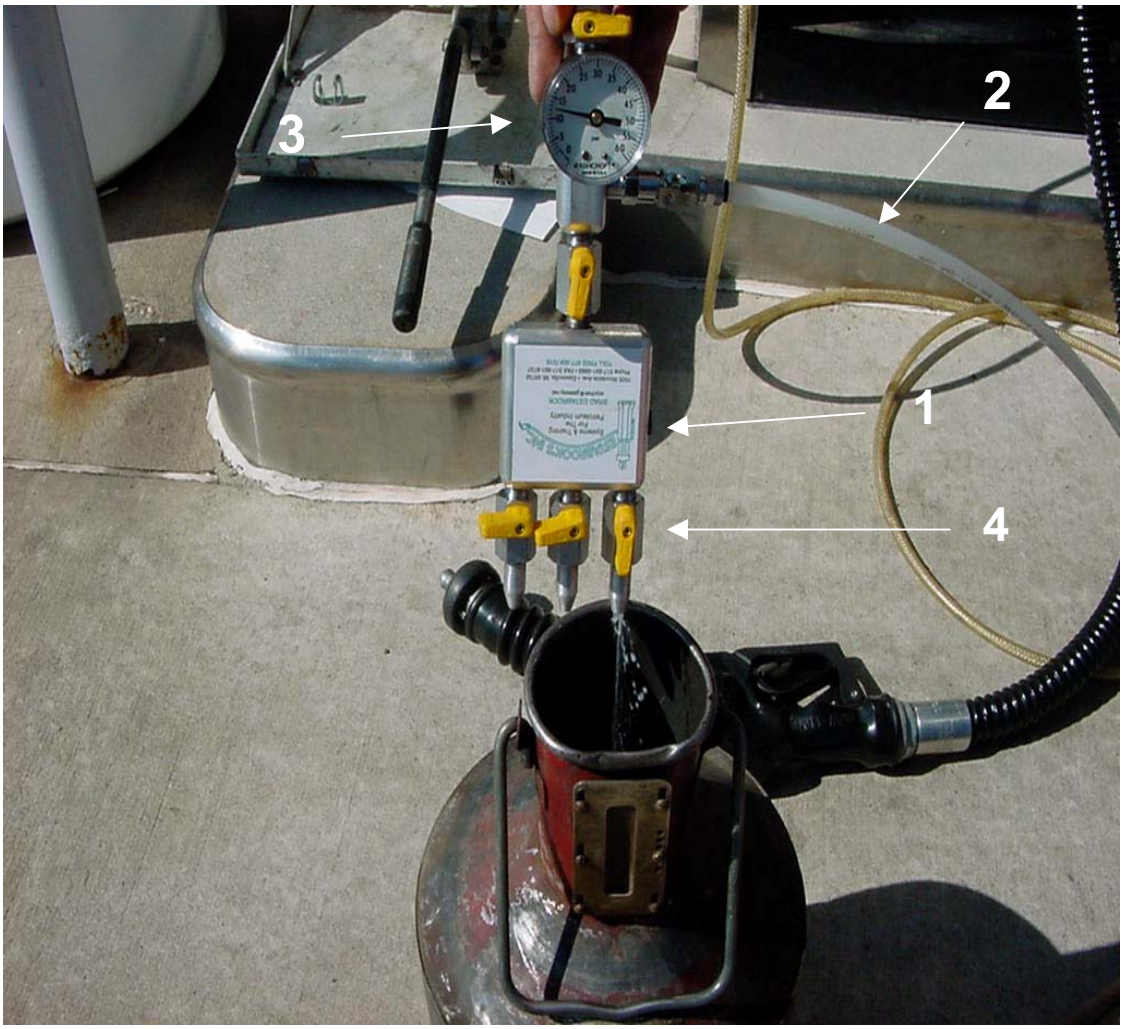
In this sump is a Veeder-Root volumetric LLD (1) (“lunch box”) which is capable of line tests at .1, .2 and 3 gph which is why an LLD is not fitted to the STP LLD port (2). Note the presence of the required LLD check valve (8). The copper line (3) is a siphon break which indicates the presence of manifolded tanks. A product line from another tank (9) feeds the UST and product is dispensed. A liquid sensor (4) is monitoring for product in the STP sump. The electrical junction box (5) is also present. The flex line (6) allows the STP to move without stressing the product line. The globe valve (7) is used to turn off fuel flow to the dispensers. Inspection Significance: If the check valve (8) is not present, the LLD (1) will not function properly. *See definitions: liquid sensor, volumetric LLD, siphon break and manifolded.*



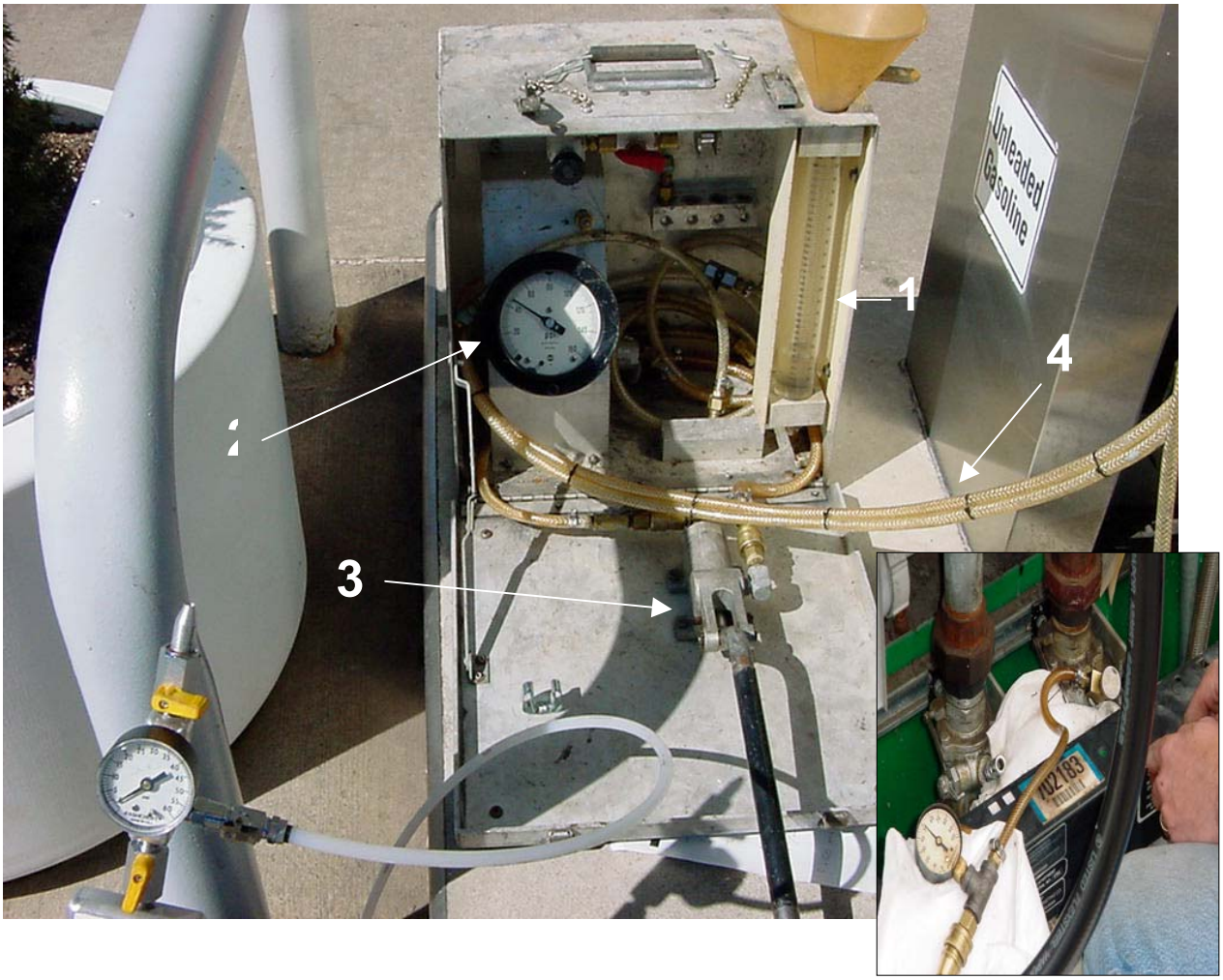
Both items are mechanical line leak detectors (LLDs) which restrict the flow of product in a pressurized system if a line leak of 3 gph is detected. These units are made by Marley Pump (Red Jacket). The unit on the left (1) with the green labeling is only used on diesel systems while the other unit (2) with the red labeling is used only for gasoline applications. Because of the viscosity difference between gasoline and diesel fuel, the two units are not interchangeable. The red plastic plug (3) is the connection for the tank vent line, typically a 1/4-inch diameter copper line. Inspection Significance: these units must be tested annually. Records of the required test should be available for inspection. Additionally, take note of the type of product dispensed from the UST to be sure it is compatible with the LLD in use. Reference page 64 for LLD test equipment.



Note: This page is for informational use only. It is not part of a routine inspection. This picture shows the equipment used to test a line leak detector (LLD). The Estabrook unit (1) is designed to produce a line leak of 3 gph. Line (2) is connected to the shear valve of the dispenser and is pressurized by the turbine. The pressure gauge (3) displays the product line pressure. The calibrated nozzle (4) allows only a 3 gph leak rate which should trigger the LLD to restrict flow to the dispenser. The 5-gallon calibrated bucket is used to catch the gasoline pumped during the test. Once the 3 gph simulated leak has been established, the turbine should only generate a line pressure of approximately 10-15 psi and only a trickle of gasoline will come out of the nozzle. If the LLD fails the test (does not restrict product flow), the gauge (3) will show a line pressure of 35-45 psi.

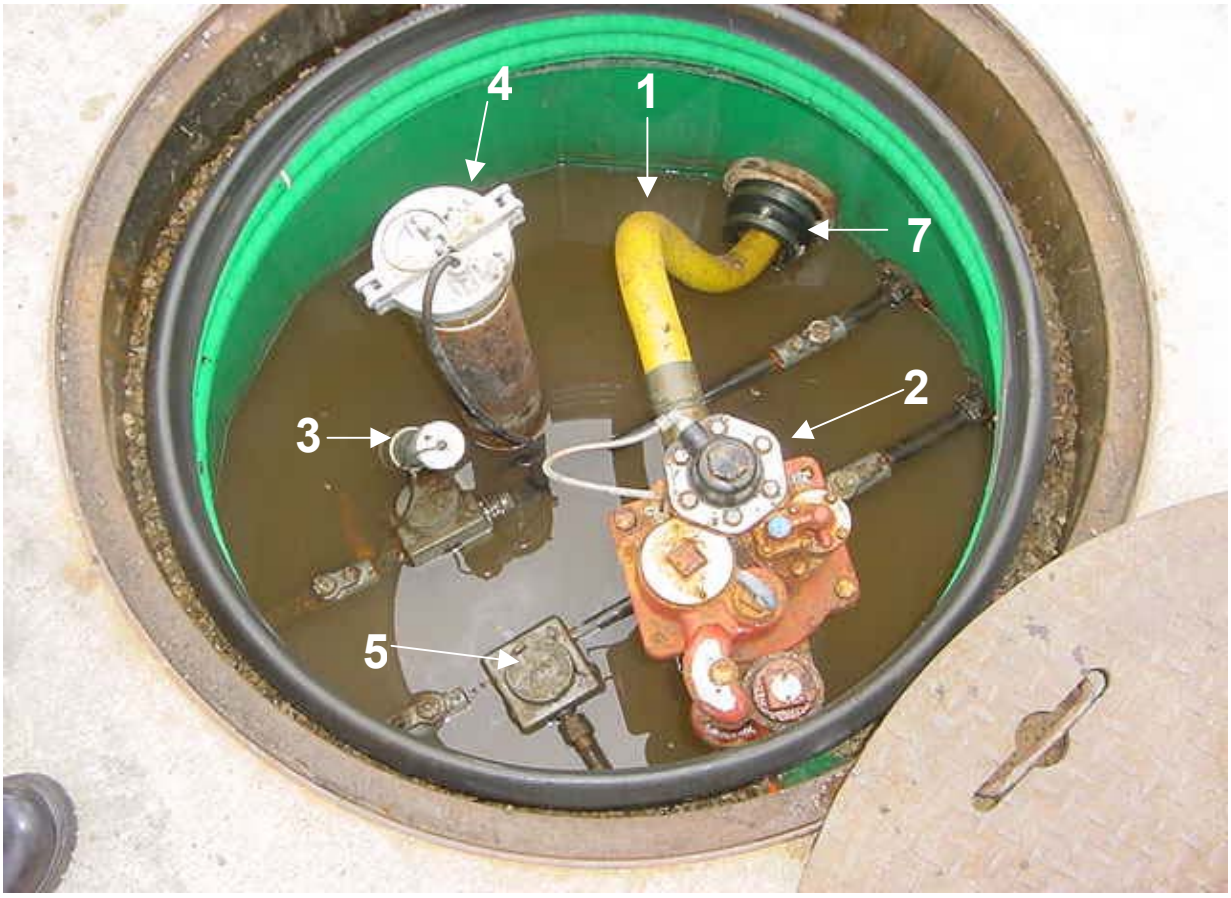


Note: This is page is for informational purposes only. It is not part of a routine inspection. This unit is used for testing product lines, specifically a Petro Tite® test. The graduated flask (1) contains product. The test lines (4) are connected to the 1/4" NPT outlet on the shear valve (see inset photo). The pressure gauge (2) monitors any decrease in line pressure during the actual test. This test uses gasoline to pressurize the product lines. Some line tests use helium or nitrogen instead of product. The line being tested is isolated from the tank by closing the globe valve at the tank sump or by closing the functional element. The tester then pressurizes the line by pumping the hand pump (3) until 50 psi is measured on gauge (2). Over a period of time, as determined by the test protocol, the pressure on gauge (2) is monitored for any drop in line pressure which may indicate a leak. In addition, the amount of product used to maintain the 50 psi is measured in the graduated flask (1).

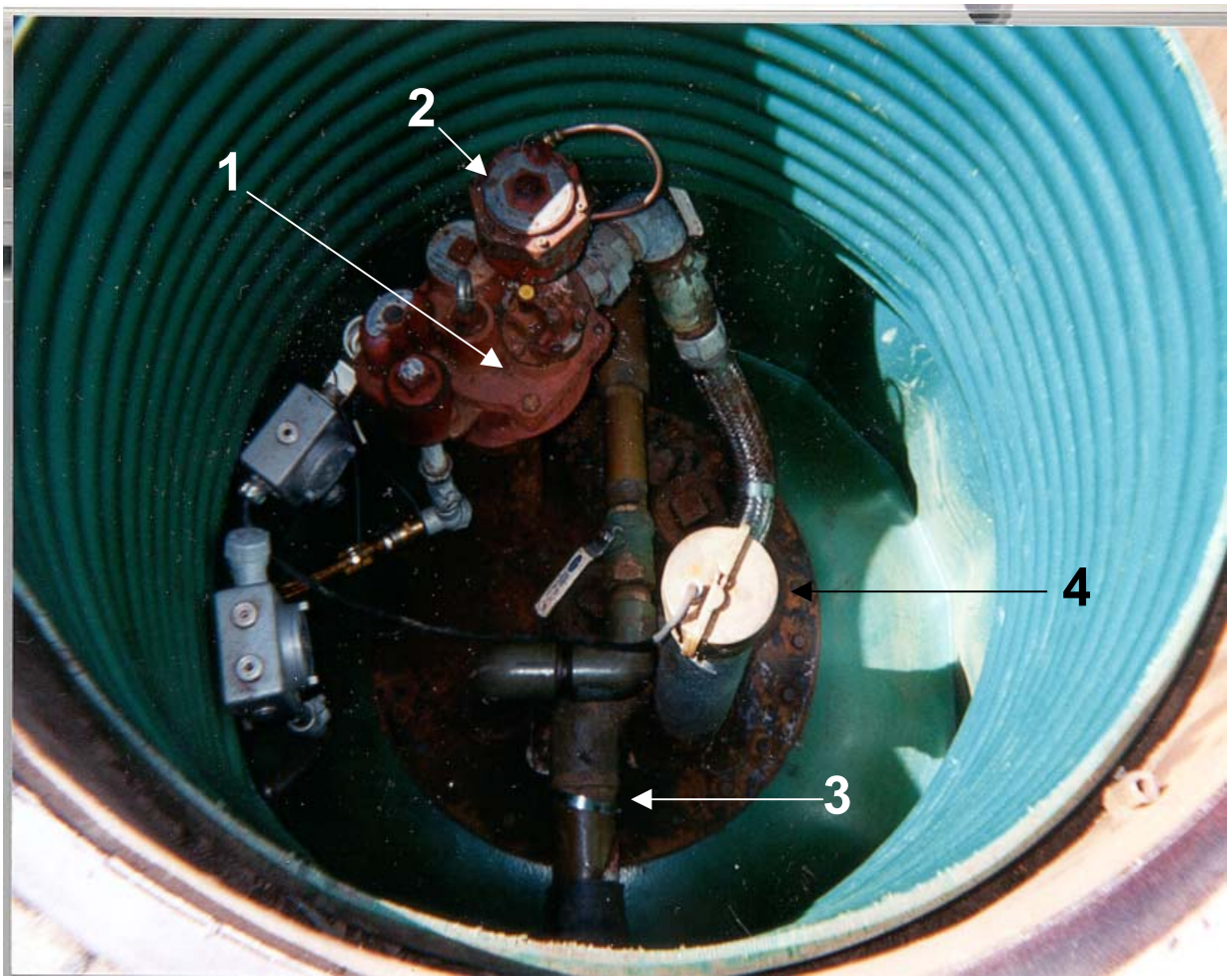


The common name for this device is a “Silver Bullet”. It is used by tank testers to isolate the tank from the product lines. The line leak detector (LLD AKA Red Jacket©) is removed from the STP and the silver bullet is inserted in the LLD opening. The 1/4” pipe plug on the top is used to pressure the lines during a “Petro Tite” test or similar line test. This item is also used during tank testing to isolate the tank being tested from the product piping. Inspection Significance: Although this item is not part of your inspection, it is referenced here because it will be mentioned at some time concerning tanks and line testing. Knowledge about all tank and line equipment can and will be useful.

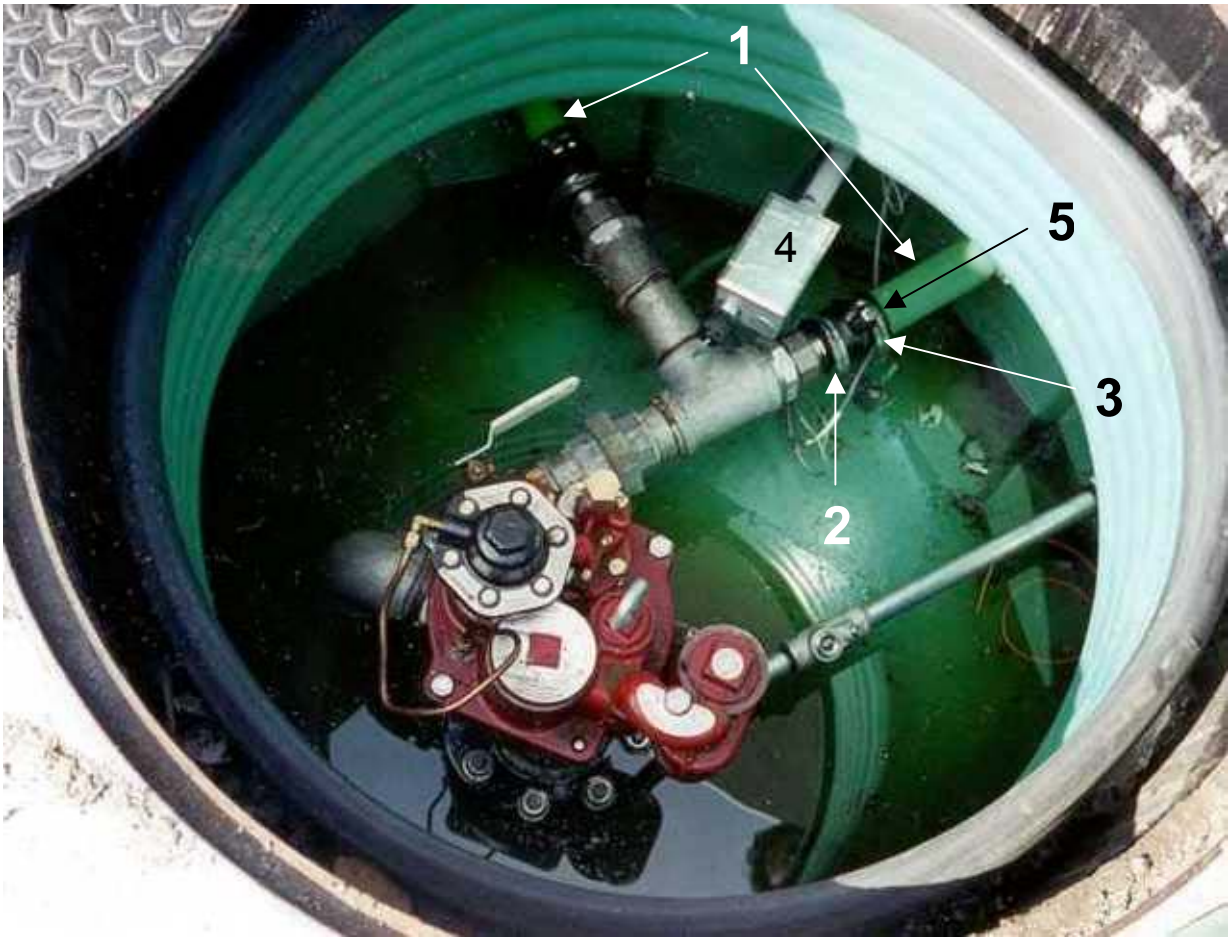
This STP sump shows several pieces of equipment. The product piping (1) is made by Total Containment and is a flex-product line. Note the presence of a liquid sensor in the sump (3). The mechanical LLD (2) is a "Red Jacket" FXV series, and tests the line to 3 gph. The STP also houses an ATG tank probe (4). An electrical junction box (5) and the steel sump cover (6) are also shown. At location (7) is a test boot which is loose allowing any product leaking from the primary line (1) to drain through the interstitial space between the primary and secondary line into the sump. From the equipment present in this one STP sump, it can be determined that flex piping is present and that the STP sump and tank are being electronically monitored. Inspection Significance: The presence of water in the sump may suggest that the containment is not product tight. If product were present in this sump, the owner or operator would be required to verify the integrity of the containment sump. The owner or operator must be able to verify if the sensor (3) is discriminatory, (i.e., can distinguish between product and water). *See definitions: ATG probe, liquid sensor, LLD and flex line.*



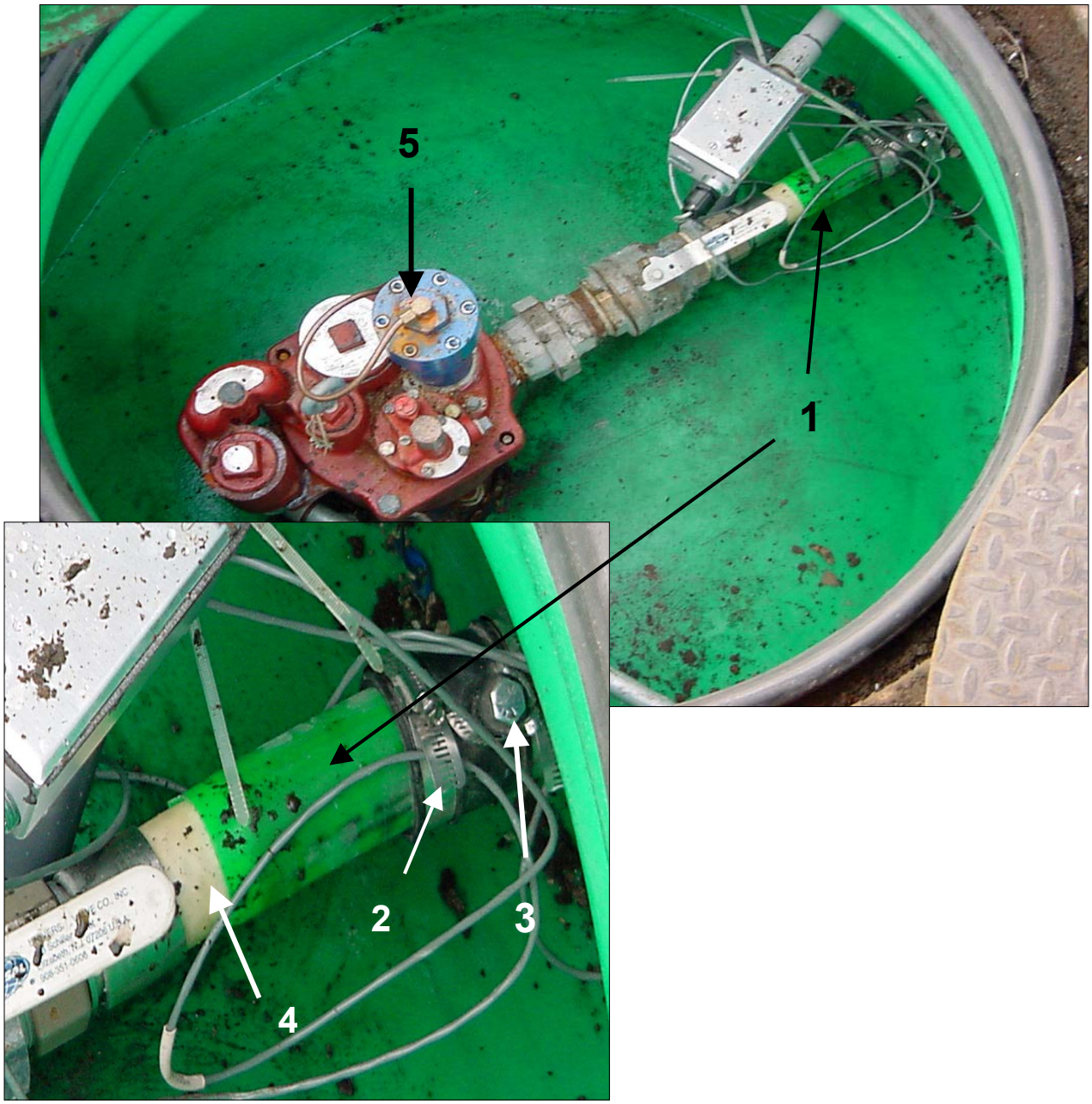
The “Red Jacket®” STP (1) is fitted with an LLD (2). The double-wall fiberglass piping (3) is monitored for leaks with the liquid sensor not visible in the photo. The STP sump also contains an ATG probe (4) for tank-leak detection. Inspection Significance: Determine if the LLD is vented to the proper port (see Turbine Diagram) and, if test boots are present, are they loose so a leak can enter the sump and be detected during monthly monitoring. Have the owner or operator run a test to verify that all probes are functioning. *See definitions: ATG probe, liquid sensors and LLD.*



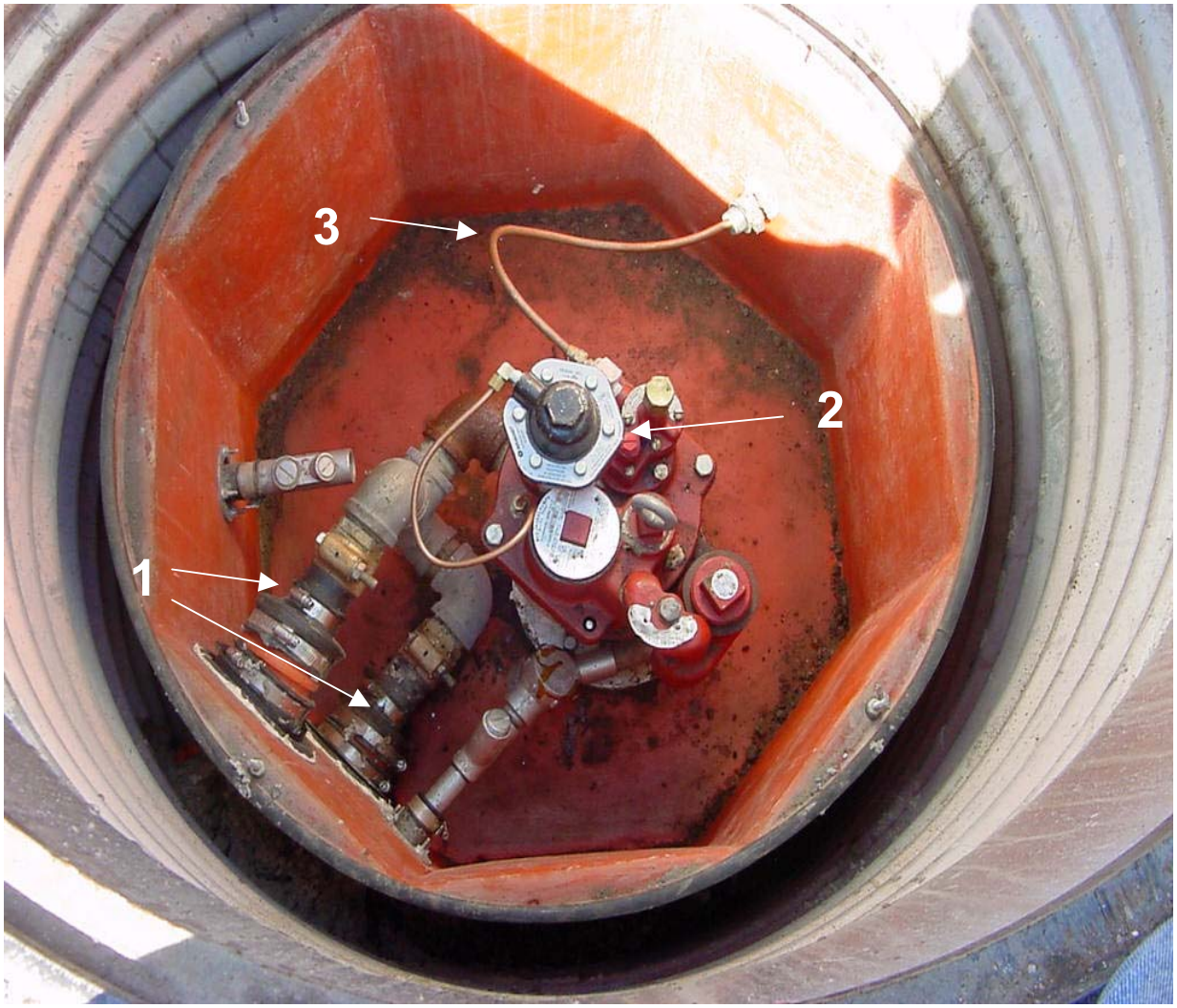
The product piping is Geoflex® double-wall flex pipe (1). The boot (2) is in the proper location and the nipple (3) is present. This nipple is connected to the interstitial area of the line. If a leak occurs, the product will come out of the nipple and will be detected by the liquid sensor [view blocked by the junction box (4)]. Inspection Significance: This STP sump has a very subtle problem. The owner or operator thinks he is doing line leak detection, but is not. In this case, a steel bolt (5) has been inserted in the nipple and the product cannot enter the STP sump and be detected by the liquid sensor. (Note: The bolt was added to pressure test the interstitial space of the double-wall piping, and the tank contractor forgot to remove the bolt at the conclusion of the test.) The result is a failure to perform line-leak detection. Take your time, and examine all the equipment. <u>You do not want to sign off on a site that is not in compliance</u>. Have the owner or operator remove this bolt. *See definitions: liquid sensor and interstitial.*



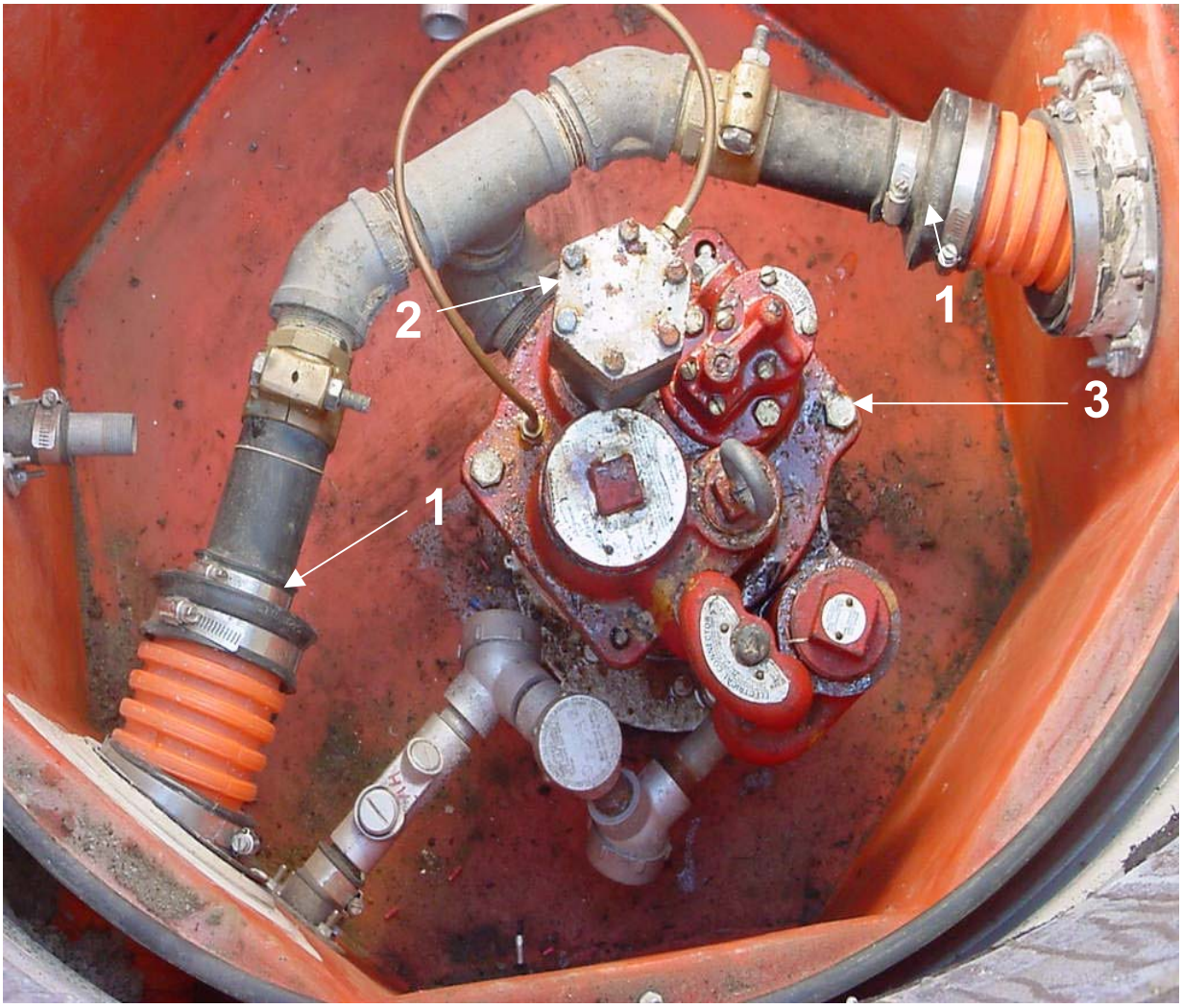
The product piping is Geoflex® double-wall flex pipe (1). A sump sensor for line leak detection is present, but not visible in the photograph. Inspection Significance: The initial reaction is that the owner or operator is not conducting line leak detection with the sump sensor because the nipple on the test boot (2) is plugged with a bolt (3); therefore a line leak to the interstitial area cannot reach the sump sensor. Upon closer inspection, it must be noted that a portion of the outer wall (green) of the double-walled piping has been removed at (4). The inner wall (tan) can be seen and the test boot has been slid back, exposing the interstitial area of the piping so a line leak can reach the sump sensor. To test the interstitial space of the line, the test boot is slid back over the open space at (4) and the clamps tightened. The bolt (3) is then removed and a test line can then be secured to the nipple to either pressurize the space or draw a vacuum on the space to run the test. In this case, determine if the sensor is functioning and if the FE Petro mechanical LLD (5) has been tested annually as required.



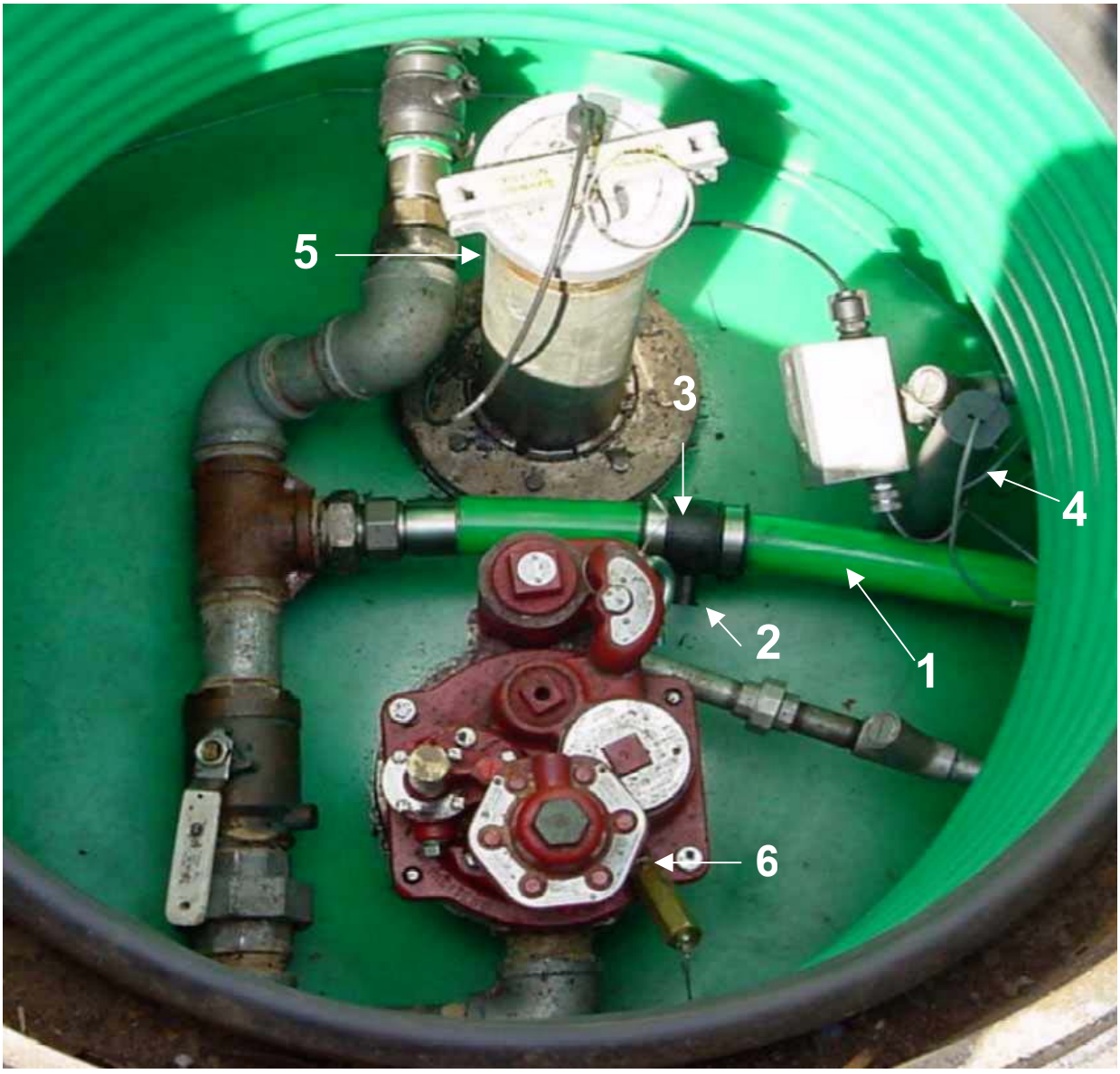
Another example of an STP sump. The site is using double-wall piping, and there are product-tight test boots (1) fitted to the piping. There are two important points demonstrated here. 1) An LLD (2) is present which detects leaks of 3 gph or greater. The LLD must be tested every year. Records should be available which document the testing of the LLD. 2) A siphon break for a manifolded system or a siphon line from a drop tank is also present (3). Inspection Significance: The method of monthly line-leak detection is not clear because a liquid sensor is not present. If one were present, the test boots are tight which would not allow product from a line leak to enter the sump. Get the owner or operator to confirm the method of line leak detection (annual tightness test or monthly monitoring), and verify his records. Also verify line construction here and at the dispenser. *See definitions: liquid sensor, interstitial, boot, siphon break, Stage II and drop tank.*



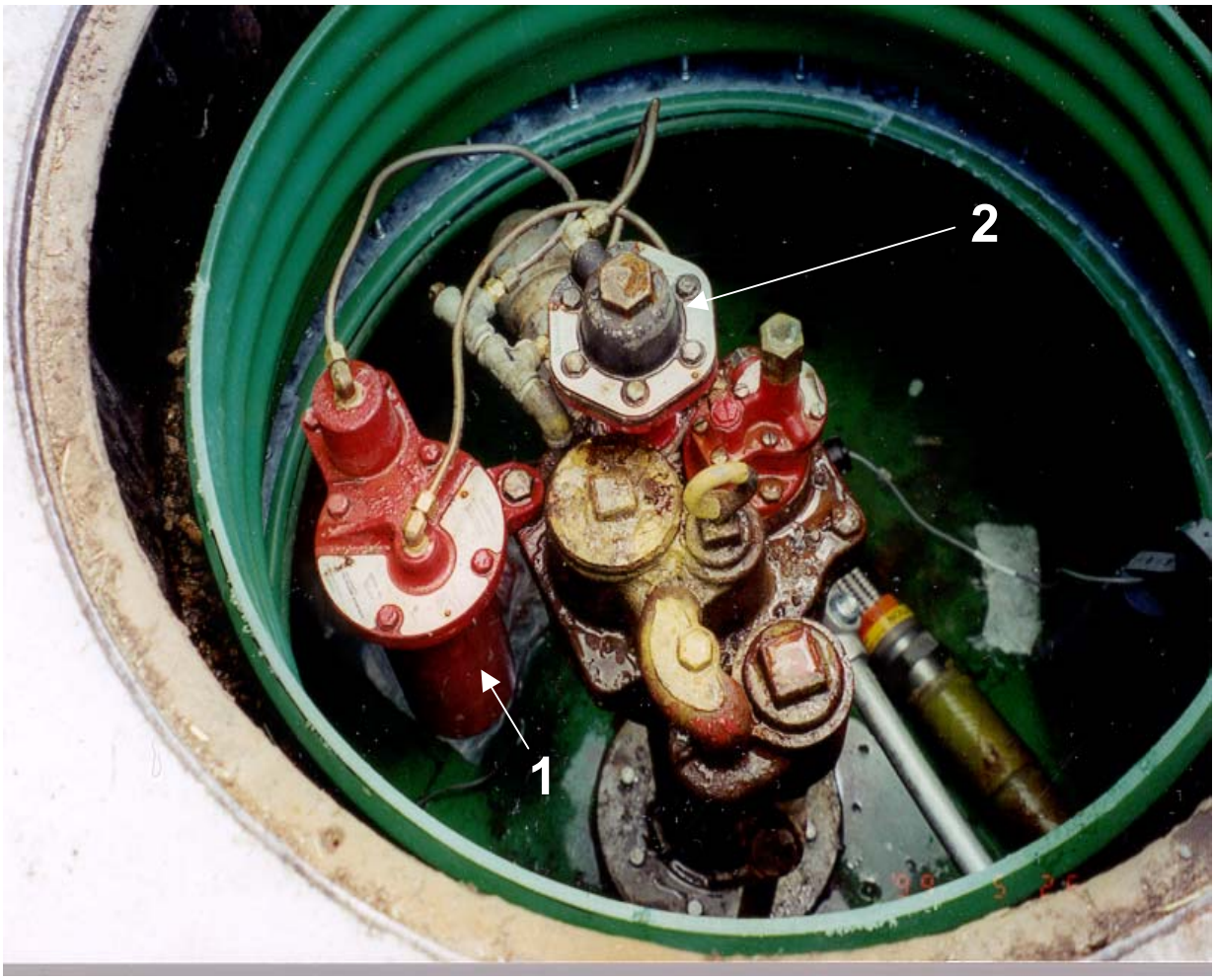
This sump contains a “Red Jacket®” STP (3), and is fitted with a VMI LD-2000 LLD (2). Although not as common as a “Red Jacket” or FE Petro LLD, these are seen at some sites. The sump has double-wall piping, and reducer boots (1) are present. The clamps on the boots are tight which would prevent leak detection of the lines using a liquid sensor in the STP sump. In this case, the fact that the boots are tight does not matter, because a liquid sensor is not present. Inspection Significance: In this instance, the inspector must determine what the owner or operator is doing for line-leak detection. The LLD is only capable of detecting leaks of 3 gph (i.e., catastrophic releases). In addition to the LLD, line leak detection includes either monthly line leak detection (i.e., .2 gph or 150 gallons in 30 days) or an annual line tightness test. Also verify construction of the piping here and at the dispenser to determine if corrosion protection is a requirement. *See definitions: liquid sensor, boot and interstitial.*



A view of a recent upgrade of equipment. The double-wall flex piping (1) has a boot (3) and nipple (2) present. If the line is leaking, product will enter the STP sump through the nipple and can be detected by the liquid sensor (4). Also present in the sump is an ATG riser with the ATG probe (5) and an LLD (6). Inspection Significance: This one picture shows what the site is doing for line and tank leak detection and, potentially, overfill protection (ATG unit). In this case, an overfill alarm connected to the ATG panel was present near the fill ports to alarm the delivery driver when the UST was 95% full. It also verifies line construction. A very clean and satisfactory installation. *See definitions: liquid sensor, boot, ATG probe, ATG, overfill, flex piping and interstitial.*

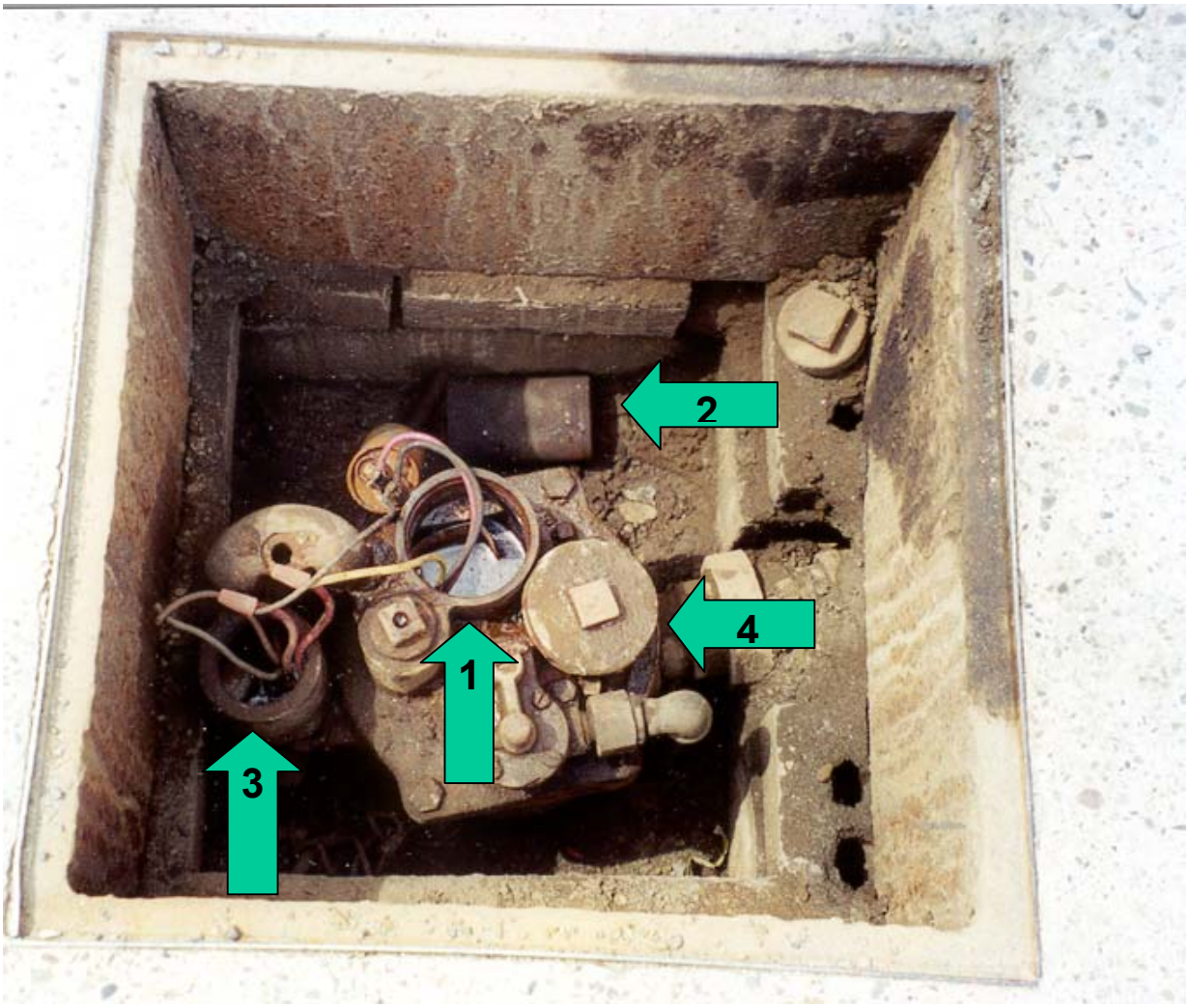


This is a Marley “Red Jacket” vacuum breaker (1). The vacuum breaker stores up to 1.2 quarts of product to be released into the product lines during extreme thermal contraction conditions. Cold temperatures can cause product to reduce in volume dropping the line pressure to below 0 psi under non-pumping conditions. This causes the LLD (2) to falsely trip, thus restricting flow from the turbine. Inspection Significance: The vacuum breaker is not required, but can prevent false shutdowns of the system. Verify the line construction to determine if corrosion protection is a requirement and the line-leak detection method used by the owner or operator, (i.e., monthly monitoring or annual line tightness test). *See definitions : Accumulator.*

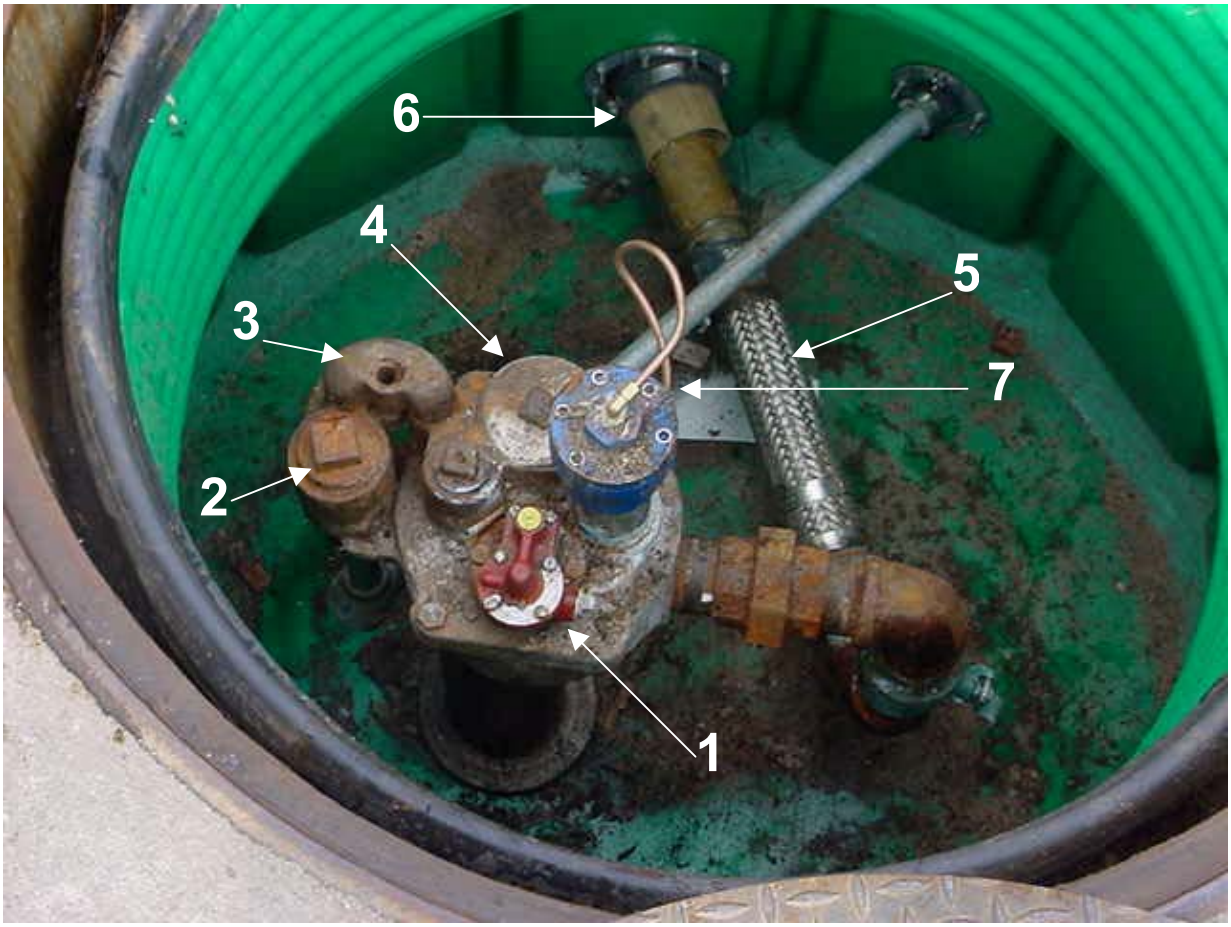


This is an example of what you don't want to see. The "Red Jacket" STP is missing an LLD (4), the capacitor housing (1) is open and filled with water, an old capacitor (2) is lying in the sump and bare wires carrying 220 VAC (3) to the motor are exposed. Yes, the wires are live! Do not touch any exposed wires! Be careful, you may encounter the unexpected during the inspection. A call to the local construction official should be made for electrical code enforcement violations.

Inspection Significance: Documentation of an annual line tightness test or the method of monthly line-leak detection must be verified and, because an LLD is not present for the required 3 gph continuous test, a citation should be made. Verify line construction to determine if corrosion protection is a requirement. *See definition: LLD*.

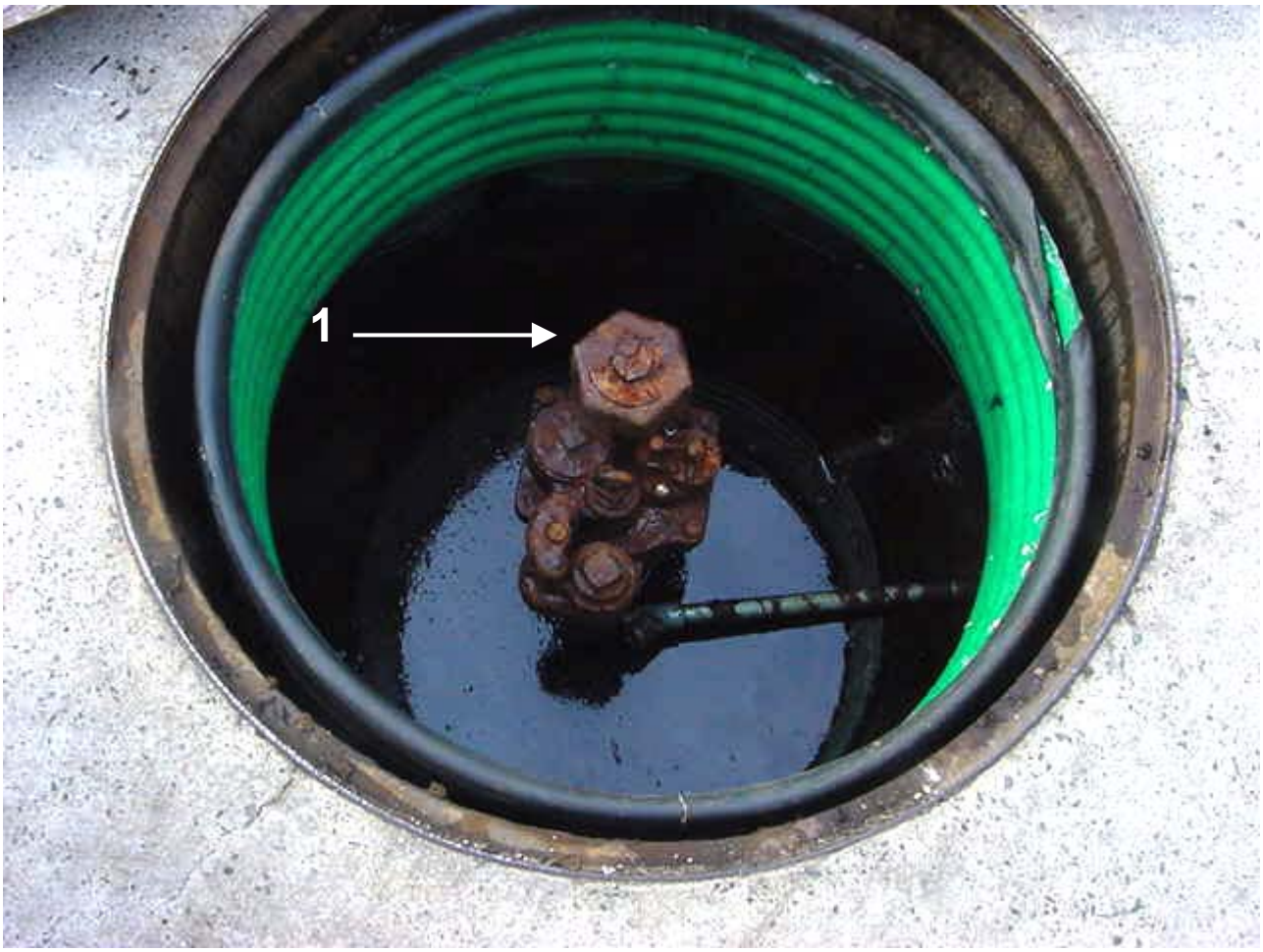


This is a typical STP sump. Double-wall fiberglass piping (6) without a test boot is present. Both the inner and outer piping can be seen. An F.E. Petro LLD (7) is located on the "Red Jacket" STP; (4) is the capacitor housing, (3) is the wiring conduit to the wiring housing, (2) for the STP motor. Item (1) is a functional element, while item (5) is the steel-flex line. Inspection Significance: A liquid sensor is not present so the method of line-leak detection cannot be determined by observing the sump equipment. Verify what method of monthly leak detection the owner or operator is using for the lines and USTs. Verify line construction to determine if corrosion protection is a requirement. *See definitions: liquid sensor, test boot, LLD, functional element, capacitor and interstitial.*

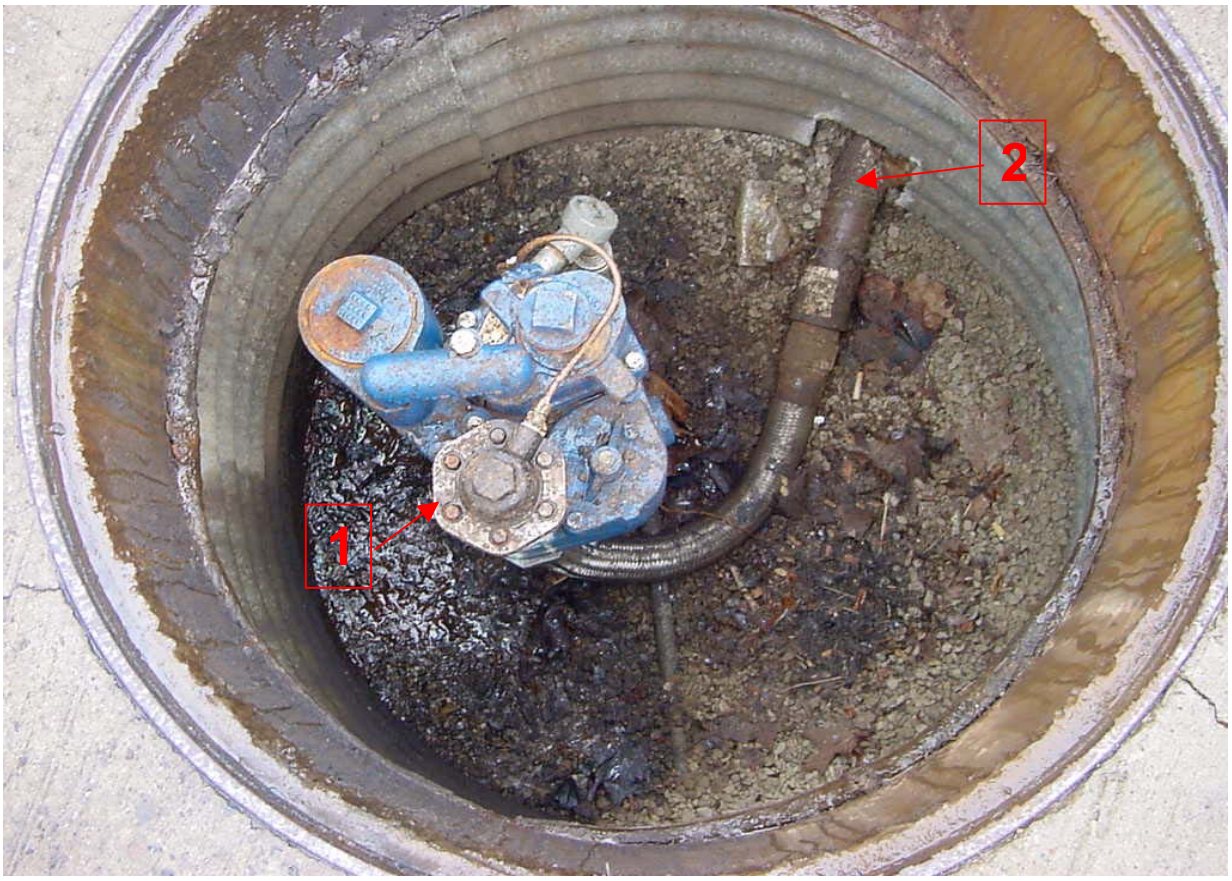


This sump contains a manifolded product line. This is further supported by the absence of an STP and the presence of a siphon break (1). Manifolding of tanks is most commonly encountered with regular-grade gasoline and diesel fuel because of their higher sales volume relative to other grades of motor fuel. Manifolding of tanks eliminates the need for an STP and additional product lines. *See definitions: manifold, siphon break and STP.*

A typical older STP sump installation. A diaphragm “Red Jacket” LLD is present (1).
Inspection Significance: The method of monthly line-leak detection is not obvious from the equipment present. Confirm what the owner or operator uses for monthly line-leak detection. It is important to confirm if the liquid is water or product. Water detection paste can be useful to determine the identity of the liquid. If the liquid is product, the source must be determined, and the integrity of the STP sump must be verified to eliminate the possibility of a discharge to the environment. In most cases, the owner or operator should be instructed to cease use of the STP immediately and to remove liquid. *See definitions: STP, STP sump and LLD.*

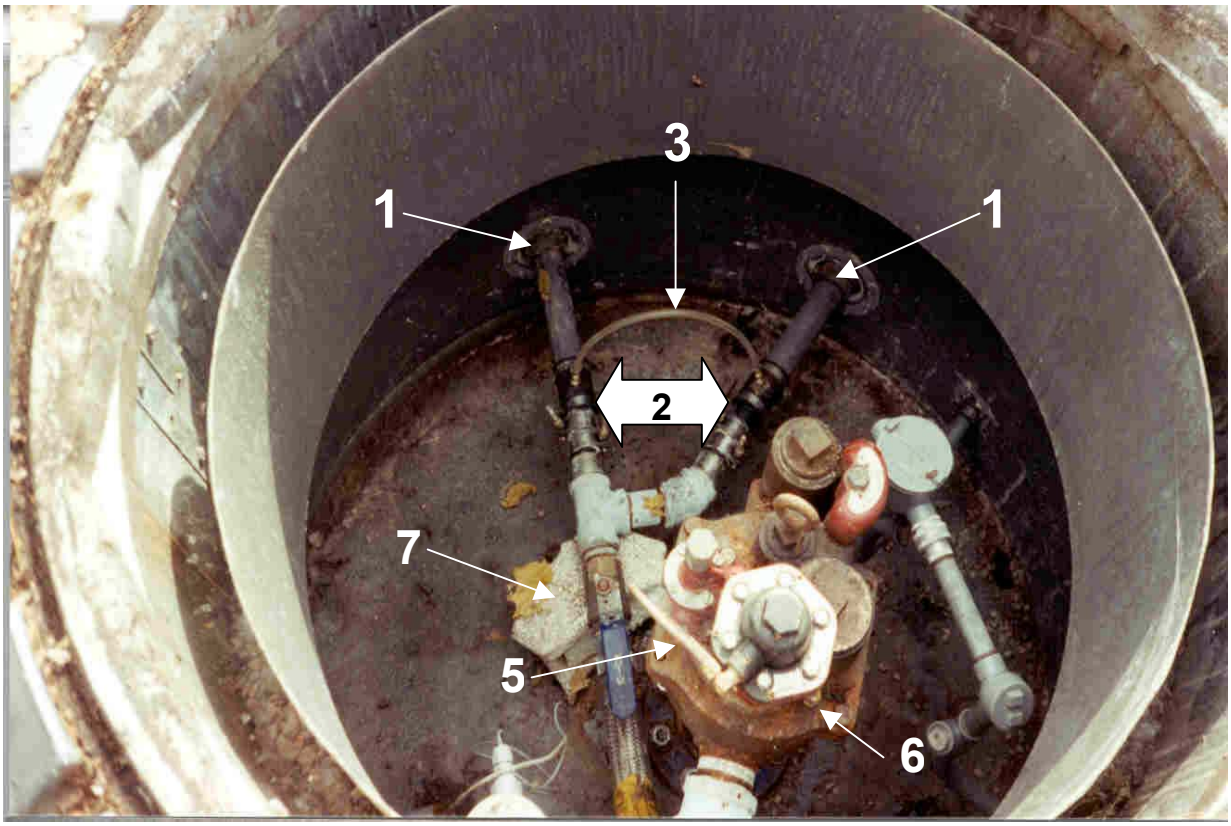


This STP is manufactured by F.E. Petro and has been fitted with a “Red Jacket®” FX series LLD (1). Note the single wall product piping (2). Inspection Significance: the method of monthly line-leak detection cannot be verified by the sump inspection alone. Confirm if an annual line tightness test is being conducted or whether some other method of monthly monitoring for the line is being conducted. Also note, because a product tight sump is not present, leaks from the turbine can directly impact the environment (note the leakage by turbine). Such discharges must be reported to the DNR Spill Line at 515.281.8694. Verify the line construction type (fiberglass, flex or steel). *See definitions: STP, STP sump, LLD.*

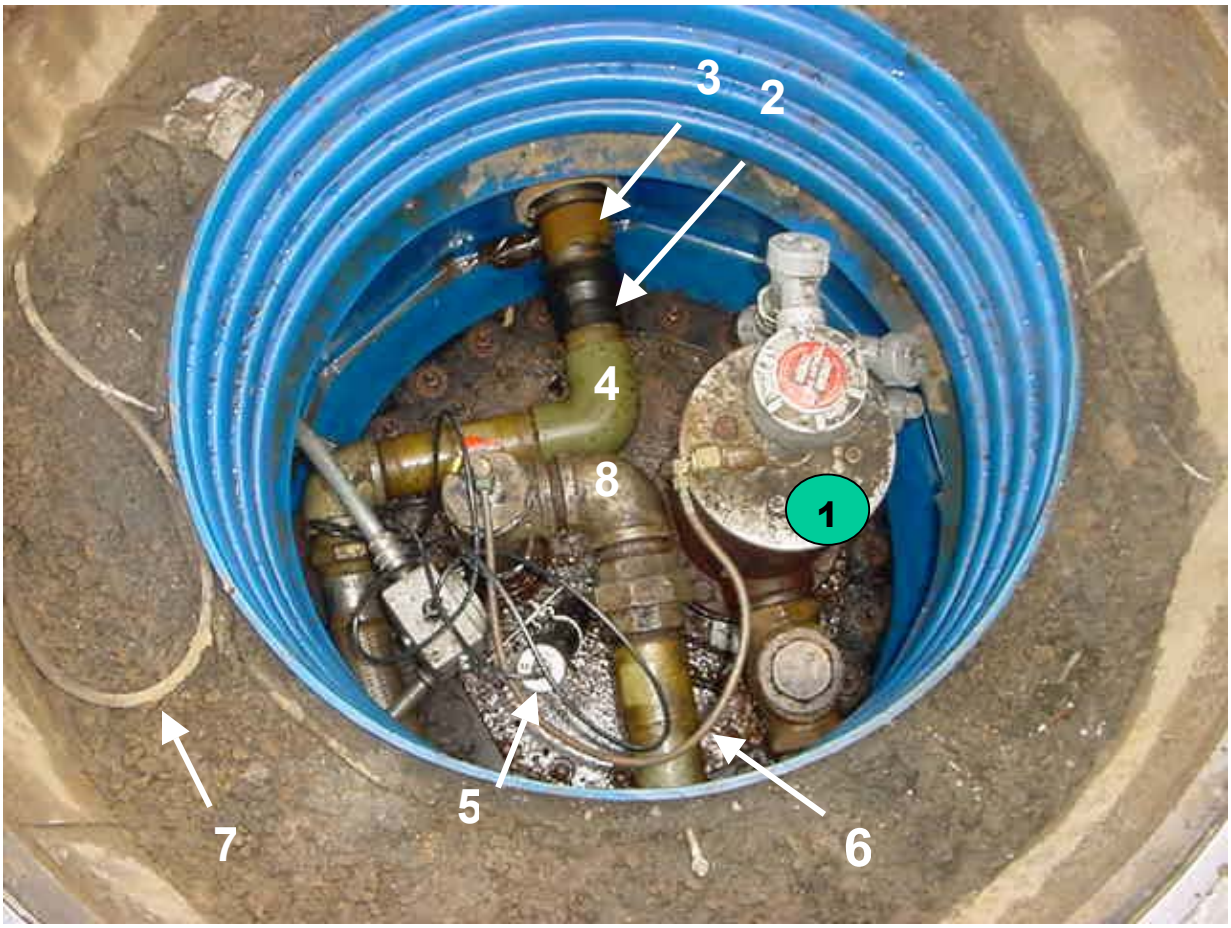


The one item of note is the fiberglass reducer (2) fitted to the double-wall piping. The inner pipe (1) can be seen. Rather than using a flexible test boot, the reducer (2) is epoxied and mechanically fastened to the double-wall piping. A steel pipe (3) allows product to enter the sump, if a line leak occurs. The product can then be detected by the liquid sensor (4). The use of boots is more common. Item (5) is a manifold line from another UST containing the same product and item (6) is an LLD required on pressurized systems. Inspection Significance: verify the method of monitoring for the UST and that the LLD has been tested annually. *See definitions: liquid sensor, boot, STP sump, fiberglass reducer and interstitial.*

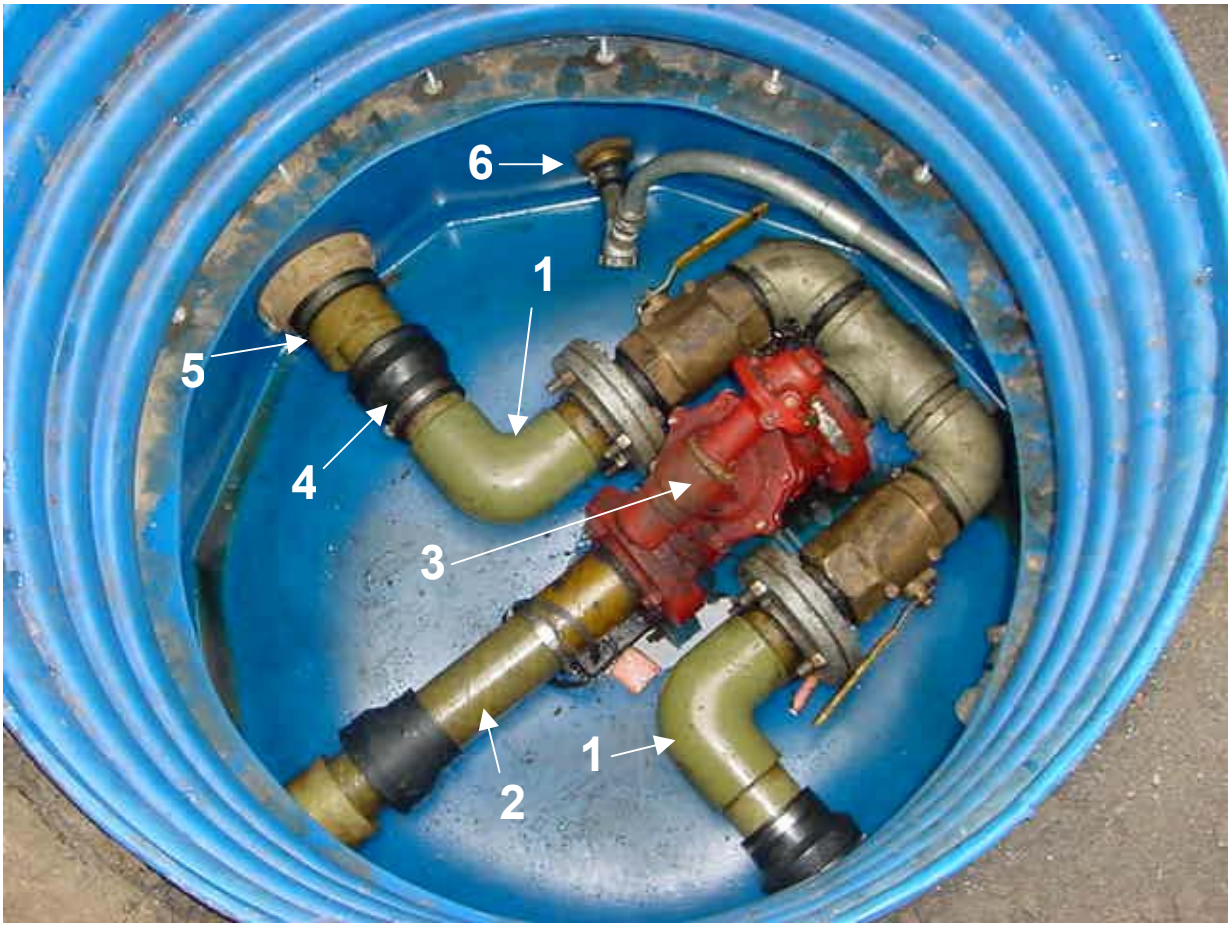
There are two double-wall flex pipes (1) exiting the STP sump. The boots (2) are the problem. Although not seen in the photo, the site is using liquid sensors to detect line leaks. The hose (3) that connects the two boots prevents product from entering the STP sump where it can be detected by the liquid sensor. The hose was added to pressure test the lines, and the testing company forgot to disconnect the hose at the completion of the test. The rock (7) supporting the flex lines is not referenced in API 1615. Inspection Significance: Due to the presence of the hose (3), the owner or operator is not performing monthly line-leak detection. Have the owner or operator remove the hose in your presence and explain the nature of the violation. Note: Vent line from the FX series (5) LLD is not connected to the tank-test port (6); however, it is vented to the atmospheres and therefore will work. Have owner or operator verify the performance of the LLD. During all inspections, verify line construction at the sump and the dispenser and the UST leak-detection method. *See definitions: Boots, Liquid Sensor, STP sump, STP.*



This is a view of an STP sump at a truck stop. The high volume Marley “Red Jacket” Big-Flo® (1) pumps fuel from the tank and then to the dispensers by way of the delivery line (4). The product piping is double-wall fiberglass reinforced plastic. The test boot (2) has been pulled away from the outer wall of the piping (3). This allows product from a leaking inner line to run into the sump and be detected by the liquid sensor (5). Since the sensor is present, you should look for a monitoring unit in the station building. Another piece of information is the copper line (6) which is a siphon break. Its presence indicates two tanks have been manifolded. Line (8) is the product-transfer line from the other tank. Also note the wire (7) outside the sump. This is a cathodic test wire which is connected to the tank. The positive terminal on the ranging voltmeter is attached to this wire for a test using the half cell. *See definitions: STP, STP sump, test boot, liquid sensor, half cell, manifold.*

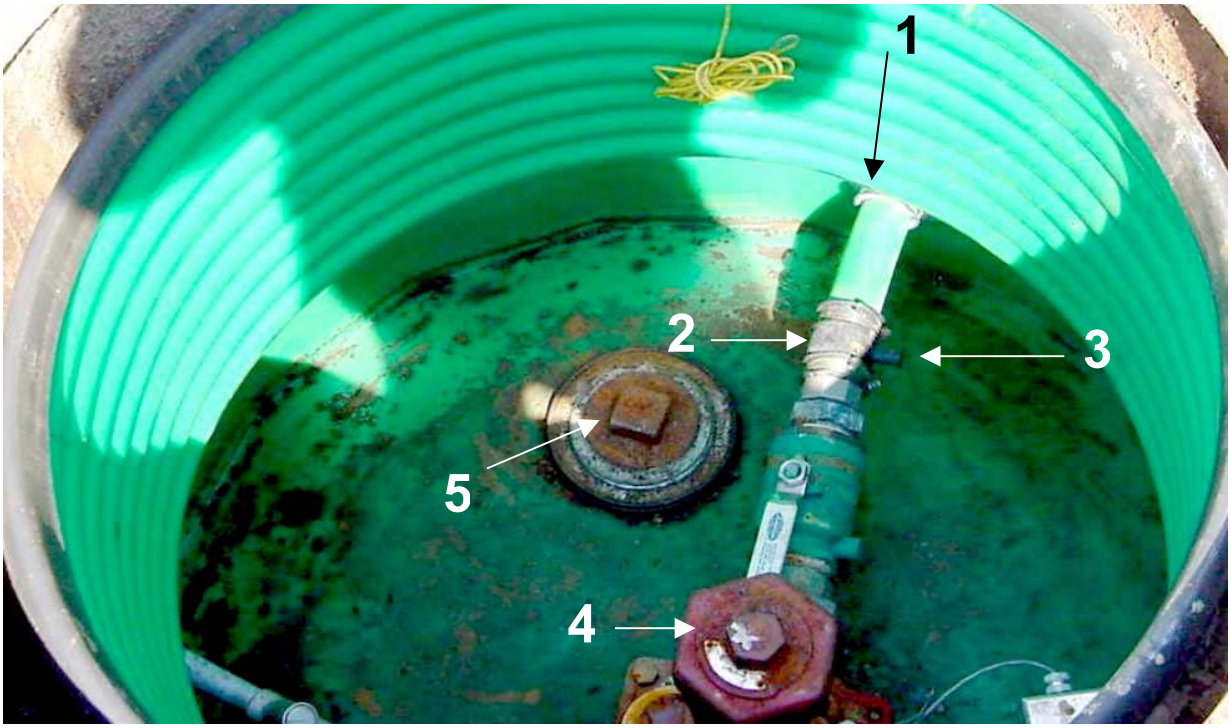


This sump is located at a truck stop which has four manifolded diesel tanks. All the product output lines (1) pictured run to the dispensers through the connections in this sump. The output line from the STPs (2) is fitted with a line-leak detector (LLD/"Red Jacket®") (3) which detects a leak of 3 gph or more. Inspection Significance: The test boot (4) has been pulled away from the outer pipe (5) of this double-wall fiberglass reinforced plastic system so a leak can be detected in the sump with a liquid sensor (present but not visible in this photo). The LLD must be tested every year and the owner or operator must have documentation supporting that the LLD has been tested and is functioning. Also note whether the perforations for the electrical conduit (6) are sealed and if the product sensors are set above or below this level. Department inspections at some sites have found sumps with open perforations and the sump sensor set at a level above the perforations! *See definitions: STP, STP sump, LLD, Red Jacket and test boot.*



This STP sump is located at a marina. The purpose of the twin turbine installation is to service multiple dispensers at the dock area. The lines are double-wall Geoflex®. Also note the tank system is manifolded to another diesel UST located adjacent to the photographed UST. This is evidenced by the manifold line (1). Inspection Significance: The method of line-leak detection cannot be determined since no sump sensors are present. The owner or operator must document what monthly method of line-leak detection is being used. Also note that neither turbine has the required automatic line-leak detectors [plugged LLD port (2)] to meet the 3 gph leak rate for large releases. An NOV was issued for failure to perform required line-leak detection.

The use of Geoflex® double-wall piping (1) is clearly shown. The test boot (2) with the nipple (3) is shown. Other equipment present is the LLD (4) and the bung (5) that covers an opening in the tank for an optional riser such as an ATG probe. Inspection Significance: make sure the test boots (1) are not plugged or, if no test nipple is present, that the clamps holding the boot in place are not tight which would prevent product from a line leak from entering the sump and being detected by the sump sensor (present but not visible in this photo). Confirm that the LLD has been tested annually. Require a printout from the monitoring panel that verifies the number of sensors present and the status of the sensors. Confirm the monthly method of leak detection for the tank portion of the system. During all inspections, verify line construction type at the sump and at the dispenser and compare your findings to the listed registration information for the site. Require any discrepancies with the listed registration information to be rectified. *See definitions: liquid sensor, test boot, LLD, flex piping and interstitial.*



In this sump is part of a manifolded tank system. The sump pictured here does not have an STP, but is connected to a tank that does have an STP by means of the manifold line (1).
Inspection Significance: Even though there is a minimal chance of a leak from the piping, the owner or operator has chosen to fit a liquid sensor (2) for leak detection. A tank bung (3) can be used for an optional riser. *See definitions: STP, liquid sensor and manifolded.*

The flex connector (pictured below) is twisted, pinched and kinked and the cause of a release when the turbine sump in which it was installed was not contained.

Inspection Significance: Flex connectors must not be bent beyond the minimum bend radius allowed by the manufacturer, nor should they ever be installed with a kink or twist. Observe the stainless steel braiding of the flex connectors to ensure they are installed properly. Owner/operators need to work with their Iowa licensed installer to determine when these flex connectors should be replaced. They may not last as long as expected as they are subject to line shock as well as high stress and pressure especially where there is a bend in the flex connector.

LINE PRESSURE SYSTEMS AND
LINE LEAK DETECTOR MONITORING

PPM 4000

Automatic Electronic Line Leak Detector

Red Jacket
Marley Pump Co.
9650 Alden Rd.
Lenexa, KS 66215
Tel: 913/541-2985

Evaluator: KWA - 04/94

System Description: *The PPM 4000 is a programmable line pressure and probe monitoring system utilizing eight independent channel control functions for use in detecting product discharges from UST's and supply lines. The line pressure monitoring system is capable of automatically testing at catastrophic (3 gph), standard (0.2 gph) and precision (0.1 gph) levels. Tests begin after each operation of the submersible pump and every time the line pressure falls to 10 PSI or upon demand. Alarm and pump shutdown will occur if the system detects a leak of 3 or 0.2 gph. The PPM 4000 is also capable of performing liquid and vapor monitoring. Eight additional channels can be monitored with the installation of the PPM 4100. To check most current information, continue to depress the SCAN key. Date and results of most recent line tests will appear.*

Certification: 3, 0.2, 0.1 gph with PD = 100% and PFA = 0%

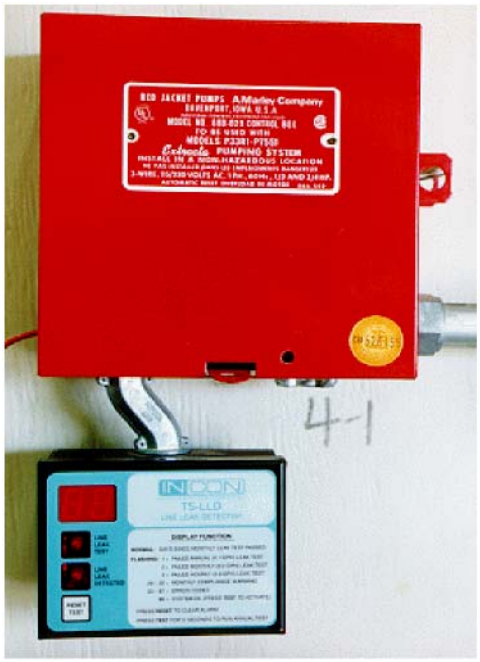
Pipeline Capacity: Max. 55.1 gal

Test Period: 3.0 gph - 1 min
0.2 gph - 10 min
0.1 gph - 2.5 hrs

TS-LLD

Electronic Line Leak Detection System

INCON
PO Box 638
Saco, ME 04072
Tel: 207/283-0156



Evaluator: KWA - 07/06/95

System Description: *The INCON TS-LLD line leak detector has two major "system" components. The Leak Sensing Unit or LSU is installed into the line leak detector port at the submersible pump housing. The Control Unit or CU is installed above or to the side of the submersible pump relay box or motor starter enclosure. The TS-LLD system will automatically turn on the submersible pump during quiet periods to run pressurized line leak tests. A quiet period is required to complete all line leak tests. A 3.0 gph test will automatically run after every product dispense and takes 3 minutes to complete. The 0.2 gph test also runs automatically after product dispense and takes a minimum of 55 minutes to complete. The 0.1 gph test must be started manually. To conduct a 3.0 gph test, press the control unit reset/test button momentarily. The display should indicate an 88 while the button is held down. Do not hold the button for longer than four seconds or a 0.1 gph test will be started. Turn the dispenser lever on and then of to start 3 gph test. At the control unit, the Line Leak Test indicator will light. The attached page describes alarm and error codes.*

Test Period: 3.0 gph - 3 minutes
0.2 gph - min. 55 minutes to max. 8 hrs
0.1 gph - 8 hrs quite time; 40 minute test

Max. Pipeline Cap: Rigid - 163 gal
Flex - 49.6 gal

ALARM & ERROR CODES

TS-LLD

Display Code Description

00 to 28	Not Flashing (No Alarm or Error) **this is a** normal display **of the number of days since the last monthly line leak test passed.**
88	Not Flashing (System OK) **the control unit electronics and display is working correctly.**

Flashing Display - Alarm and Error Codes

1	Failed Annual (0.1) GPH line leak test
2	Failed Monthly (0.2) GPH line leak test
3	Failed Hourly (3.0) GPH line leak test
29 - 32	Alarm - Over 28 days since the last Monthly line leak test passed. The number that is flashing is the number of days since the last monthly line leak test passed.
80	Annual leak test aborted.
81	Leak Sensing Unit is out of operating range.
82	Leak test aborted -- thermal instability Leak
83	Sensing Unit is not communicating.
84	Pressurized line is out of compliance. Leak
85	Sensing Unit requires cleaning.

LINE TITE

PIPELINE MONITOR

Electronic Line Leak Detection System

Hasstech
6985 Flanders Dr.
San Diego, CA 92121
Tel: 619/457-5880

Evaluator: Ken Wilcox Ass. - 04/15/97

System Description: *The LineTite CPLD (continuous pressure leak detector) system consists of a single control panel and a remote sensor for each product pipeline. The functions of four remote line monitor sensors can be upgraded with the addition of two LineTine CPLD expansion modules (4 sensors per module) allowing control of up to twelve lines per system. The control panel provides indicators to continuously show the current operating status of the system. The indicators will show a NORMAL, WARNING or ALARM condition. An LCD Display will also continuously indicate the status of the system as well as the exact cause of any system WARNING or ALARM conditions. In the event of a system error or failed test, an internal or optional external buzzer will sound to alert the station operator. System is also capable of dispenser shutdown.*

Certification: 3 & 0.1 gph w/ PD = 100% & PFA = 0%

Test Period: 3.0 gph - 1 to 26 minutes (depending on sensor)
0.1 gph - 1.2 to 12.9 hrs

Pipe Capacity: 0.1 gph - 49.6 gal

SAMPLE REPORTS
Line Tite

1. ***Print Daily Report***
   a. Press FUNCTION **then 06**

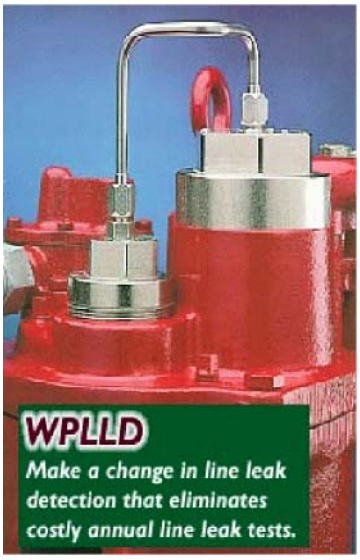
```
FUNCTION #06
-----------------------------------------
DAILY REPORT
07/24/97  14:11
HASSTECH INC.
6985 FLANDERS DR
SAN DIEGO
CA  92121
619-457-5880

CHAN #1        PRODUCT #1
3GPH TESTS PASSED:     0003
3GPH TESTS FAILED:     0002
3GPH TESTS ERRORED:    0001
   0.1 GPH TEST NOT RUN

CHAN #2        PRODUCT #2
3GPH TESTS PASSED:     0003
3GPH TESTS FAILED:     0002
3GPH TESTS ERRORED:    0001
   0.1 GPH TEST NOT RUN

CHAN #3        PRODUCT #3
3GPH TESTS PASSED:     0000
3GPH TESTS FAILED:     0002
3GPH TESTS ERRORED:    0001
   0.1 GPH TEST NOT RUN

CHAN #4        PRODUCT #4
3GPH TESTS PASSED:     0000
3GPH TESTS FAILED:     0000
3GPH TESTS ERRORED:    0000
   0.1 GPH TEST NOT RUN

-----------------------------------------
```

2. ***Print History Report***
   a. Press FUNCTION **then 16**

```
FUNCTION #16
-----------------------------------------
HISTORY REPORT
07/24/97  14:11

LAST 0.1 GPH TEST PASSED:
07/23/97 CH 1
07/23/97 CH 2
07/23/97 CH 3
07/23/97 CH 4
LAST 3 GPH TEST PASSED:
07/23/97 CH 1
07/23/97 CH 2
07/23/97 CH 3
07/23/97 CH 4
SYSTEM SETUP CHANGED:
07/24/97
-----------------------------------------
```

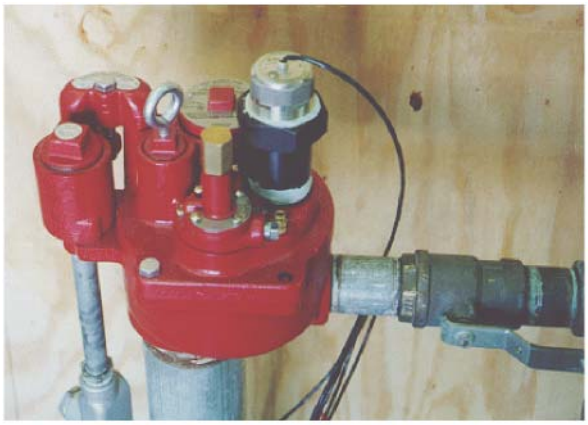
3. ***Audible Alarm Test***
   a. Press FUNCTION **then 15**

Veeder Root Electronic
Line Leak Detectors



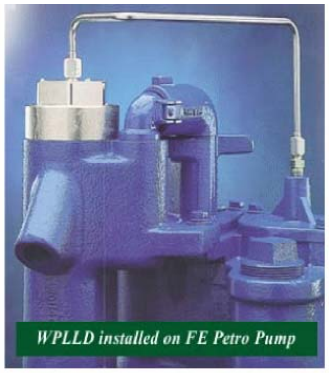
Wireless LLD

Wireless LLD w/Red Jacket pump

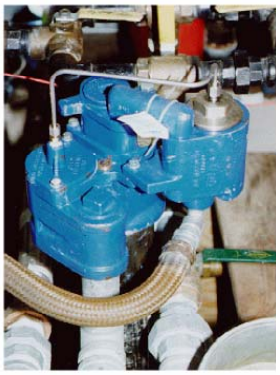


Pressure LLD (wire)

Pressure LLD (field)



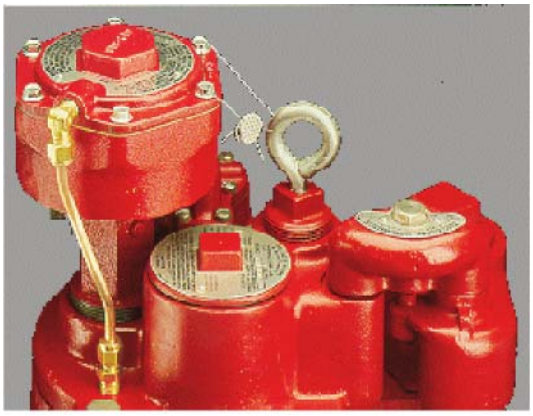
Wireless LLD w/FE Petro pump



Wireless LLD

RED JACKET
Mechanical Line Leak Detectors

Diaphragm Leak Detector (DLD)

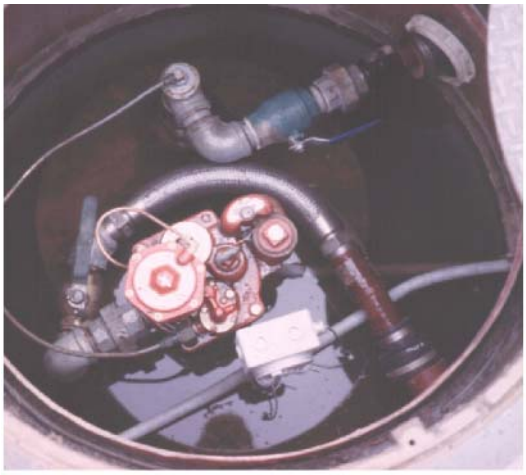


Piston Leak Detector (PLD)
(Not 3rd party certified)

Extended Life Diaphragm (XLD)

Extended Life Piston (XLP)

DLD



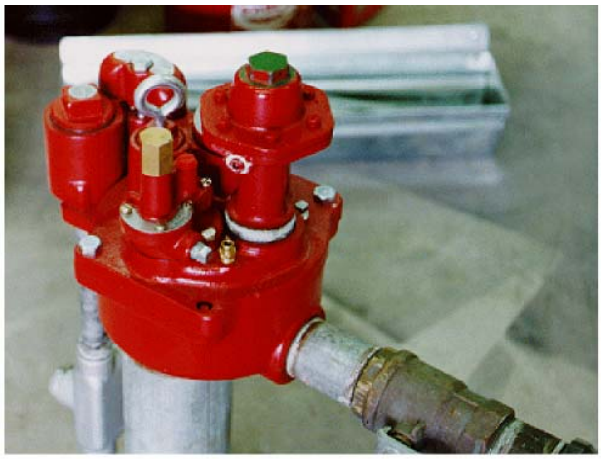
XLP

RED JACKET
Mechanical Line Leak Detectors

FX1V

FXV Series

FX2V

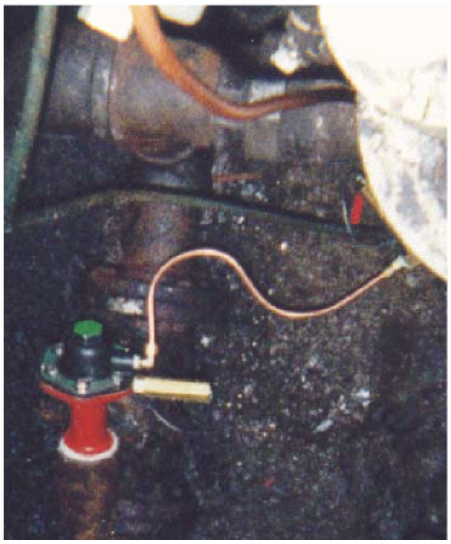


FX Model

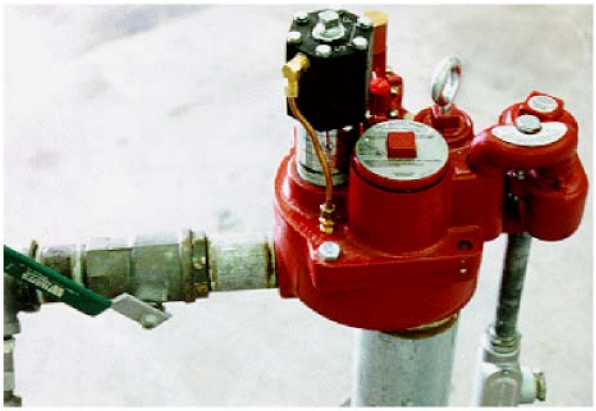
FX Model

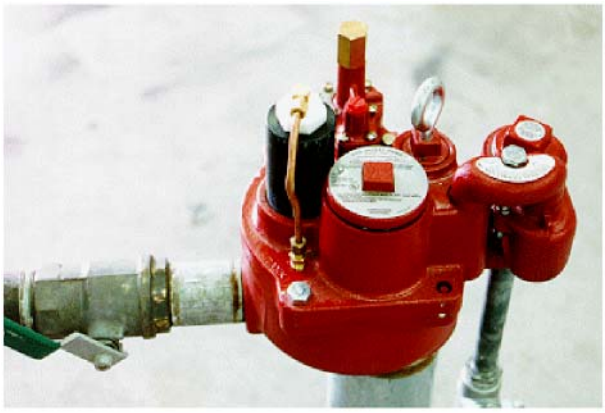
FX1V

FX2V



VAPORLESS
Mechanical Line Leak Detectors



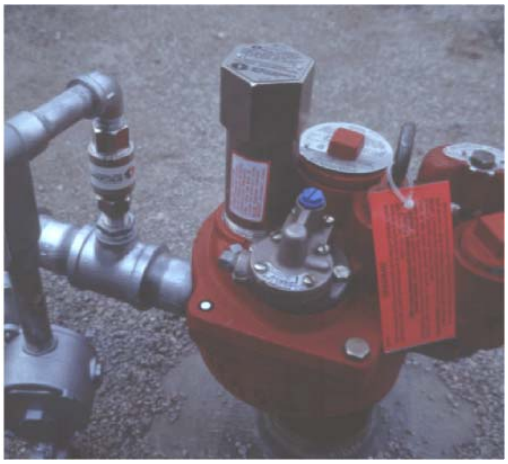


LD-2000-E

(for Enviroflex piping)

LD-2000-S

(electronically assisted pump shut down)



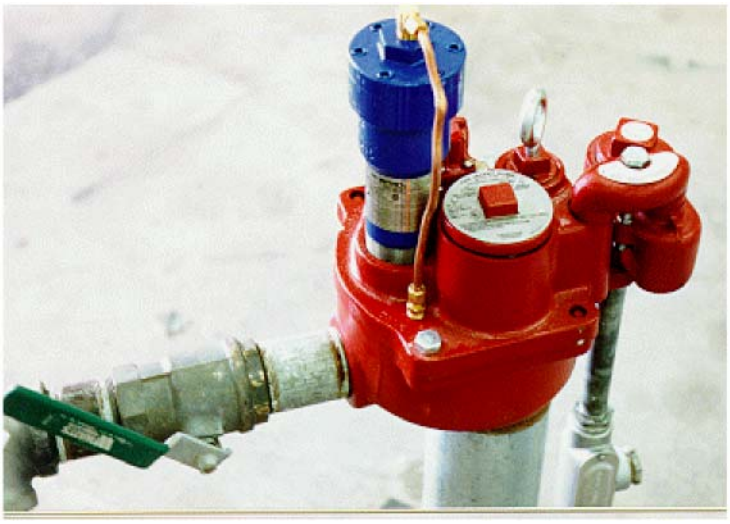
LD Accumulator

LD-2000-T

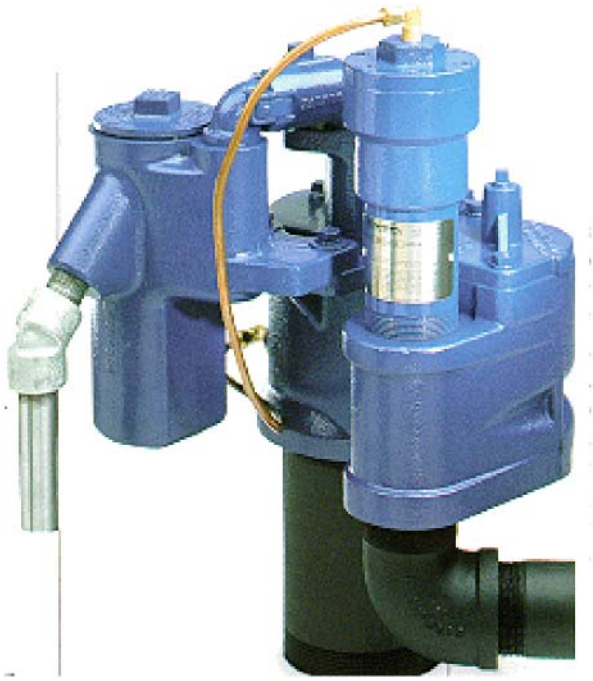
(for Tokheim pumps)

FE PETRO

Mechanical Line Leak Detector



RJ PUMP w/ FE PETRO MLLD



FE PETRO PUMP & MLLD

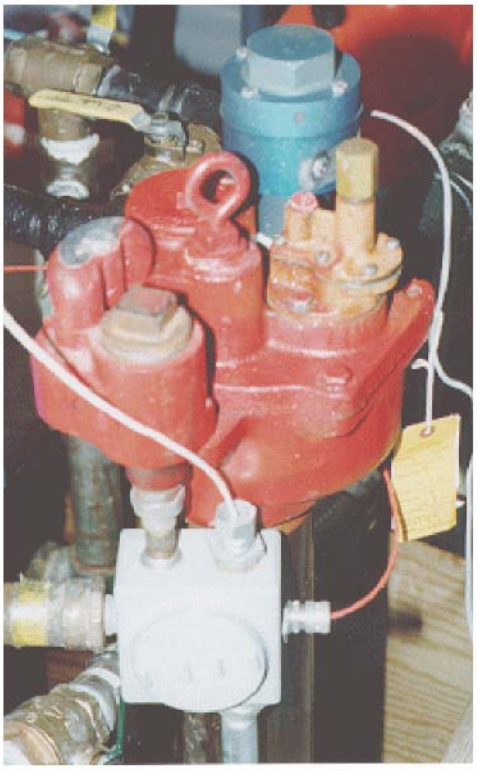
RJ PUMP w/ FE PETRO MLLD

ELECTRONIC
Line Leak Detectors

EBW (Compo Miller)

INCON TS-LLD
(wireless)

EECO-LLD



Hasstech w/RJ Pump

RED JACKET ELECTRONIC
Line Leak Detectors
for PPM4000, RLM9000 & ST1400/1800

(older model)

(plumbed)

(new model)

Monitoring Wells (Permanent and Temporary)

A monitoring well is used to obtain water quality samples or measure groundwater levels. These wells can be used to evaluate if a fuel release has occurred from a tank system, the extent of contamination across the site, and where that contaminant plume might be moving. A special type of monitoring well is called an observation well (usually large diameter). It is placed in the backfill of underground storage tanks and used for leak detection (vapor or groundwater monitoring).

Those same wells, which can provide such critical information about the state of the groundwater and soil beneath a UST site, can become a nightmare if they are not well-maintained and protected. A monitoring well that is damaged and/or poorly maintained can act as a conduit funneling contaminants from the surface down to the subsurface. This can turn an existing contamination problem into a much bigger one, or it can create a problem that wasn't there before.

The series of images shown here demonstrate examples of damage to wells or poor handling practices that may result in or have already resulted in problems.

Petroleum spill running across a monitoring well. Petroleum spills can and do happen at gas stations. Maybe a customer's car leaks gas and oil that runs into wells. Or on a grander scale, maybe the dispenser doesn't shut off or the fuel transporter driver looks away. You could soon have a stream of petroleum flowing across your site as Figure 1 shows. If this monitoring well is not in good condition or constructed properly, that fuel could be funneled straight to the subsurface. The area around a monitoring well should be sloped away from the well in order to keep surface runoff out.

This well has no cap and no locking mechanism, making it vulnerable to contamination. You also need to keep in mind that most monitoring wells need to be sampled periodically or checked for free product. If the well stays open and fills up with dirt, the owner/operator will have to repair it or possibly replace it.

This is not a good place for a permanent monitoring well. Product can leak from the dispenser, the hose, or nozzle (or all three), and into the annular fill (material around the monitoring well). This would likely flow down the well itself and into groundwater. Monitoring wells should be clearly marked so they are not confused with underground tank fill pipes.

Monitoring wells in good condition are designed to reduce the likelihood of infiltration by surface contaminants. This is done through use of bentonite pellets around the casing, and concrete to seal the mount and cap. However, even if you have a cap and locking device on your monitoring well, if it is not maintained properly, petroleum may still enter the well through cracks in the well casing or openings in the protective bentonite seal.

Even well-maintained monitoring wells can get damaged by frost heave, snowplows, and traffic. While the weather may be beyond our control, some of this can be prevented by placing monitoring wells in obscure locations, installing protective posts around them, and ensuring careful snow removal activities in areas near monitoring wells.

Examples of damaged monitoring wells that are at risk of being conduits for contaminants to the subsurface.

So what can be done to prevent this from happening? What can be done if your wells are already damaged?

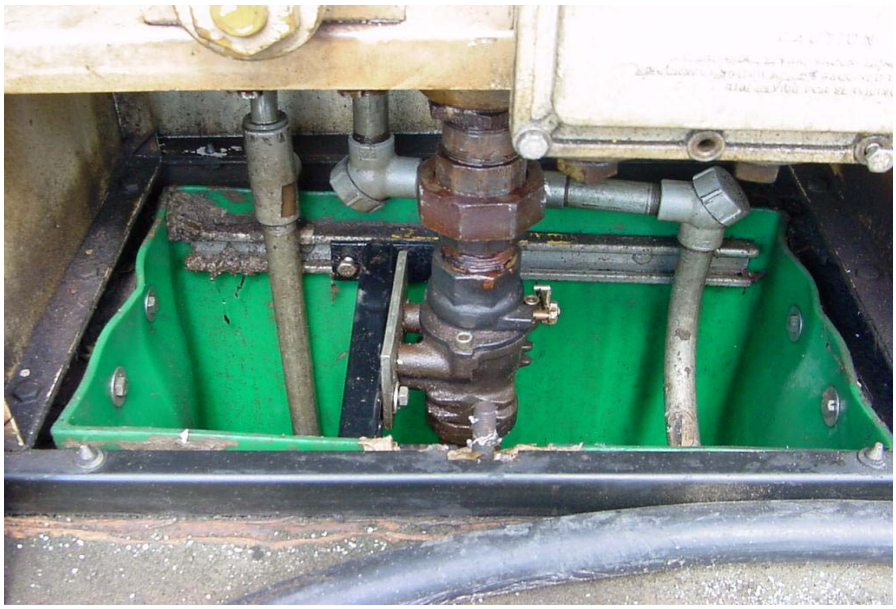
Proper monitoring well construction and maintenance includes:

1. Providing for adequate surface drainage away from the well.
2. Properly labeling each well.
3. Securing each well with a bolted cover and/or a locked cap.
4. Replacing damaged well caps and covers.
5. If possible placing protective devices (e.g., concrete or metal posts) around monitoring wells.

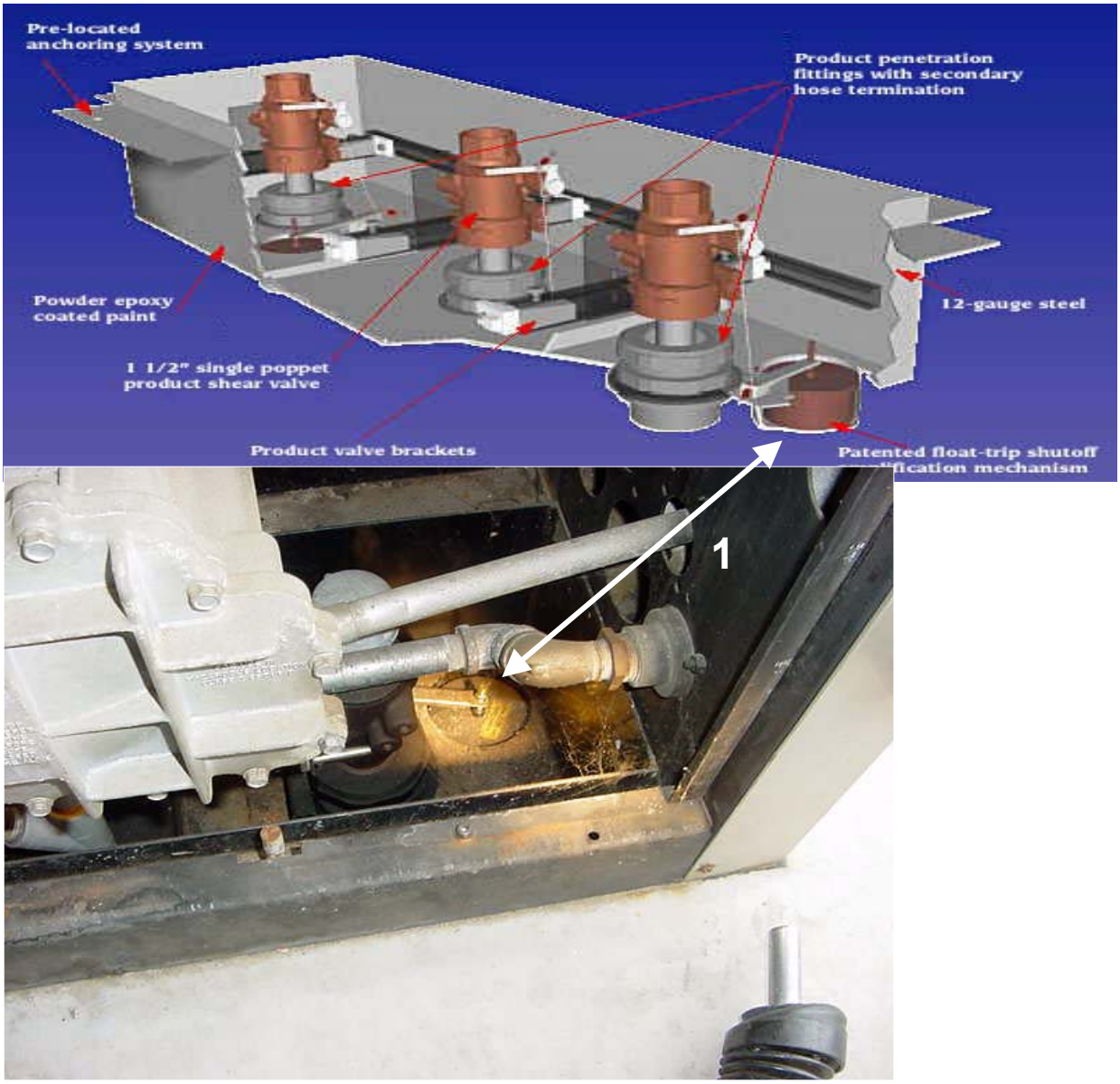
If monitoring wells installed on or off the property you are inspecting are damaged or destroyed alert the owner and make a note in your inspection report. The owner must contact the certified groundwater professional for the site and GAB Robins at 515-276-8046 immediately. If the site is funded, the costs to plug, replace, or repair the well may be covered.

Dispenser Pans

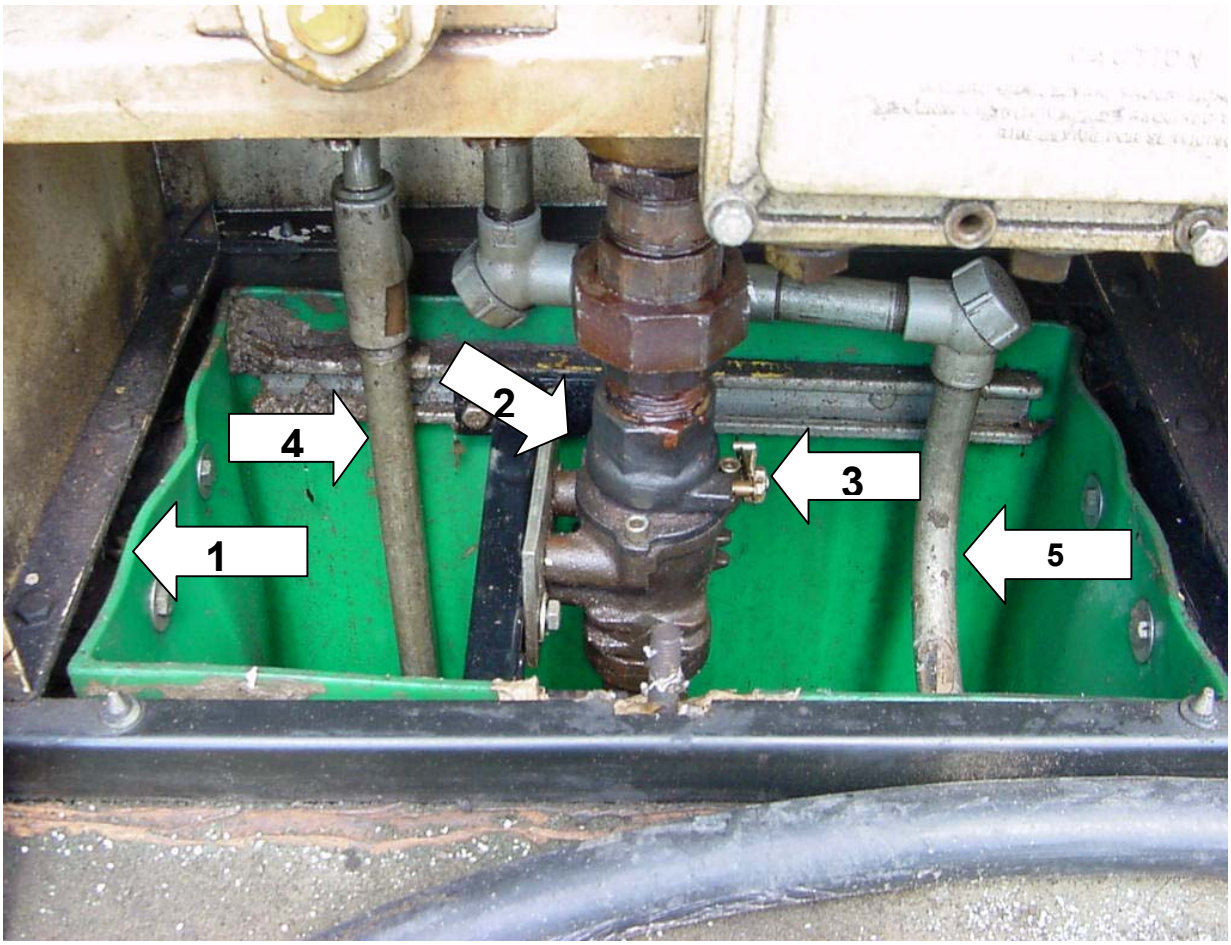
Bravo box



Although not a requirement, a dispenser pan may be present at some facilities. This pan is an example of a B-2000™ Bravo Box manufactured by S. Bravo Systems, Inc. Designed to contain any leaks from the dispenser, this unit has a float mechanism (1) which rises as product is released to the dispenser pan. When 5 oz of fuel is captured in the float reservoir, the float shuts off product flow through the shear valve and product cannot be dispensed through that line. The remaining lines entering the dispenser will still function, allowing other grades of fuel to be dispensed. Inspection Significance: a dispenser pan is not required. although they are a good management practice. Dispensers should be checked for leaks, especially if no pan is present. Environmental discharges should be reported to the Department Spill Line at 515.281.8694.



This is the base of a dispenser (the side cover has been removed). A product-tight pan (1) is installed under the dispenser. The shear valve (2) indicates that this is a pressurized system. These valves are not used on suction systems. The valve will shut off fuel if the dispenser is struck by a vehicle or by some force that breaks the dispenser free of the pump island. The fusible link (3) melts when exposed to a fire which allows the internal valve to close, thereby stopping the flow of fuel. The Stage II vapor recovery line (4) from the nozzle is just to the left of the product line. Item (5) is the electrical conduit. Dispenser pans, while beneficial for spill containment, are not required by federal or state regulations. Some dispenser pans are equipped with sensors to detect the presence of product. Inspection Significance: dispenser leaks to the environment (i.e., soils under the dispenser) must be reported to the Department Spill Line (515.281.8694). Piping construction should also be verified. *See definitions: shear valve, Stage II and dispenser pan.*



INTERNET RESOURCES

DNR UST Section: http://www.iowadnr.com/land/ust/index.html

DNR UST/LUST System Database/Public Viewing:
http://programs.iowadnr.com/ustlust/pages/advanced.aspx

Government Links:

- **EPA Home Page:** http://www.epa.gov
- **EPA: Office of OUST:** http://www.epa.gov./OUST/index.htm
- **EPA Region 7:** http://www.epa.gov/region7/underground_storage_tanks/index.htm
- **EPA Standard Test Procedures for Evaluating Various Leak Detection Methods:** http://www.epa.gov/swerust1/pubs/protocol.htm
- **National Work Group on Leak Detection Evaluations:** http://www.nwglde.org
  See Inspector Resource, Vendors and Miscellaneous Links on NWGLDE website
- **State and Territorial Directory:** http://www.epa.gov./OUST/states/statcon1.htm
- **UST State Contacts:** http://www.nwglde.org/state_contacts.html

Association Links:

- **American National Standards Institute (ANSI):** www.ansi.org
- **American Petroleum Institute (API):** www.api.org
- **American Society for Non-Destructive Testing:** www.asnt.org
- **American Society of Testing and Materials (ASTM):** www.astm.org/index.html
- **International Fire Code Institute (IFCI):** www.ifci.org
- **National Association of Corrosion Engineers (NACE):** www.nace.org
- **National Fire Protection Association (NFPA):** www.nfpa.org
- **National Institute for Occupational Health and Safety (NIOSH):** www.cdc.gov/niosh
- **New England Interstate Water Pollution Control Commission (NEIWPC):** http://www.neiwpcc.org

- **Petroleum Equipment Institute (PEI): www.pei.org**
- **Steel Tank Institute (STI): www.steeltank.com**
- **Underground Tank Technology Update: http://uttu.engr.wisc.edu**
    - **To search for back issues or topics and upcoming courses and workshops: http://uttu.engr.wisc.edu/issueindex.lasso**
- **Underwriter's Laboratory (UL): www.ul.com**

(Q:ThirdPartyInspections/ComplianceInspectorManual/sb)

Last Updated 7/12/2007